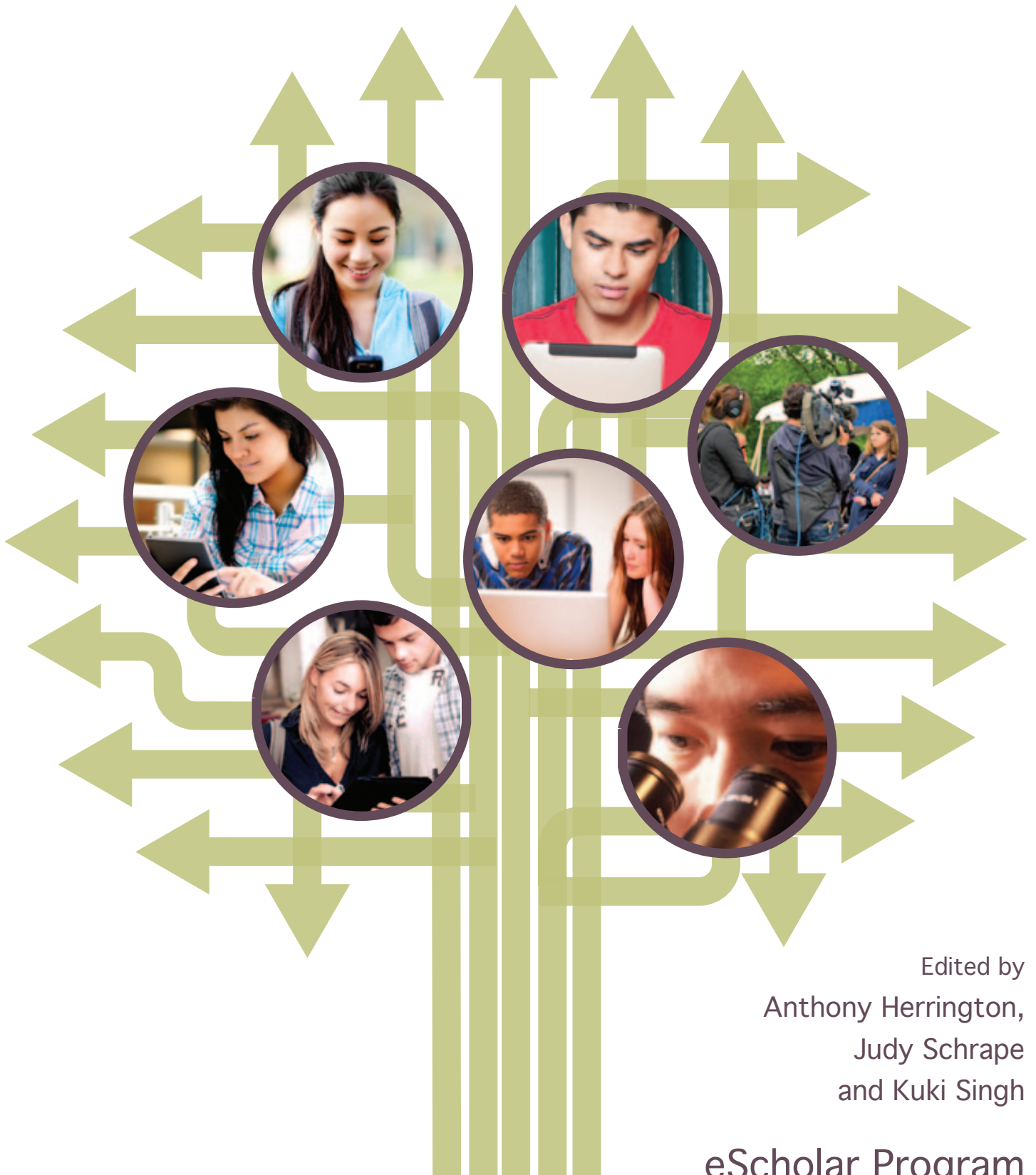




Engaging students with learning technologies



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eScholar Program

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Introduction

The context for higher learning has changed significantly in the last five years. Recent changes in technologies such as cloud-based computing, broadband, and Wi-Fi enable students to learn anytime, anywhere and with any device. Students are increasingly accessing their units via mobile devices such as smart phones and tablets.

Nevertheless, it continues to be the case that effective learning requires students to engage in challenging activities set in authentic contexts that are related to the real world and the workplace. Learning with understanding occurs in a social context where students collaborate, share, communicate and reflect on their knowledge. Learning technologies can greatly assist these processes.

Learning management systems such as Blackboard enable course information, resources and communication and collaboration channels to be available in one virtual location. Course content has been developed by teachers and text-book publishers and is increasingly generated by students themselves. Open Educational Resources OERs are becoming widely and freely available and many universities are now beginning to offer whole units as Massive Open Online Courses (MOOCs) open to any student, anywhere and at any time.

Within this disruptive context Curtin University initiated its eScholar program making funds available for academic staff to implement innovative teaching using Curtin's extensive suite of learning technologies. The program is based on the philosophy of engaging students with learning technologies that support their growing understanding through authentic and assessable activities.

This publication presents the research findings of each of the eScholar projects conducted in 2010 and 2011. Each chapter has undergone a process of double-blind review resulting in high quality descriptions of learning using current and emerging technologies. The publication is divided into 6 sections based on these technologies.

Video technology is becoming an important tool in teaching and learning. Part 1 reports on three studies where video is used as a tool to record and reflect on learning, to increase the efficiency in recognising and identifying concepts, and to enable a deeper contextual understanding of theoretical concepts through practical applications.

Social media has become an integral part of people's lifestyles and increasingly part of the educational landscape. Part 2 contains research projects that look at using blogs and journals to understand, present and reflect on weekly topics; using wikis to enable group work and peer assessment; and informal learning using Twitter.

Virtual classrooms enable a high level of engagement between students and teachers in online learning environments. Part 3 describes a study where Blackboard's *Elluminate Live* and a graphics tablet were used to review students' conceptual understandings.

An electronic portfolio has become a commonplace technology for organising and presenting a student's learning outcomes over time — used both as a self-learning and assessment tool. Part 4 reports on a study that uses an e-portfolio as a learning and professional development resource.

Cloud-based computing allows the creation of online learning environments where students and teachers can work collaboratively to post, share, edit and save files such as word documents and spread sheets. Part 5 looks at studies where students use Google Docs to collaborate in writing unit summaries and teams writing collaboratively to create websites. Another cloud-based technology was used to investigate students' development of critical thinking skills through online debates.

Part 6 involves studies where students are immersed in a variety of learning technologies including laptops, iPads, lecture capture, audience response devices, virtual classrooms, plagiarism detection software, e-portfolios and a mix of multimedia and web 2.0 technologies.

University teaching and learning is faced with many challenges. A major one is recognising appropriate learning technologies and their use that support ways in which adults learn. Rapid advances in technologies can easily seduce those with limited understanding of adult learning. This publication offers clear directions founded on teacher and learner experiences grounded in real classroom activity.

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“Mirror, mirror on the wall”: The power of video feedback to enable students to prepare for clinical practice

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KEYWORDS

Video analysis, video
feedback, reflective
practice, clinical practice

Abstract This project explored the use of video analysis of self and peer-recorded skill performance to better prepare nursing students for clinical practice. Video technology has been used as an educational tool to prepare skill development for a variety of professions. This Curtin University eScholar project enabled the use of *CRITIQUE*, a video-analysis learning tool, for the development of psychomotor skills for clinical practice. This quasi-experimental pilot study involved a convenience sample of second year nursing students. A control group experienced the traditional learning experience, whilst the intervention group combined the traditional experience with *CRITIQUE*. Pre and post-test questionnaires were used to obtain data on student characteristics, self-efficacy, impact on learning processes and usability of the program. Self-efficacy was not statistically significant between the groups; however, the intervention group showed a trend towards greater confidence and perceived ability than the control group, who trended downwards. The *CRITIQUE* experience positively influenced processes of learning, including reflective practice and 72.8% rated the experience enjoyable and beneficial. These preliminary findings are promising and a larger-scale study is warranted.

Introduction

Nursing education prepares students for entry into the professional practice domain. This preparation involves learning a combination of theoretical principles and clinical skills, as well as the development of key attributes such as critical thinking, self-efficacy and reflective practice. An essential outcome of undergraduate nursing programs is the transfer of psychomotor skills learnt in a teaching laboratory into clinical practice. Video has been used extensively in sports coaching for many years for the development of sporting and coaching skills. This project explored video analysis technology – *CRITIQUE* to develop nursing students’ clinical skills; in particular it examined the impact of video analysis on students’ perception of the learning experience, their self-reflection on performance and their preparation for clinical practice. This type of learning has been promoted in the education and professional development of teachers for many years, allowing for self-confrontation and reflection on practice (Rich & Hannafin, 2009).

The study used the principles of authentic learning, incorporating learning activities that have real life meaning to the student (Herrington, Oliver & Reeves, 2003).

Literature review

Transferring nursing knowledge into professional practice is the foundation of nursing education. Supporting knowledge transfer from the academic setting to the clinical setting aims to prepare the student to be a confident and competent practitioner (Cheraghi, Hassani, Yaghmaei & Alavi-Majed, 2009). Educational institutes are required to produce nursing graduates who are able to enter the clinical environment with clinical skills and the ability to demonstrate independent thinking and decision making (Kuiper, Murdoch & Grant, 2010). Kuiper et al. suggest that educators can meet industry demands for competent nursing graduates by maximizing the opportunity for students to practice clinical skills in the safety of a supervised clinical simulated environment.

For authentic simulated learning activities to be effective, regular feedback throughout the learning process is imperative. Feedback forms an essential component of formal assessment in education. Students are assessed at regular intervals throughout undergraduate studies to appraise skill level and competency to practice. Regular assessment of performance, both of individuals and groups, with constructive feedback from the assessor offers the student opportunities to take corrective measures to improve practice (Guskey, 1990). Guskey describes how regular evaluation and feedback, combined with encouraging student engagement, results in improved student learning outcomes. This is also supported by Ladouceur et al. (2004) who add that regular assessment and feedback is imperative to give students an opportunity to correct and develop skills. Similarly, Tanner (2006) suggests that feedback given after a simulated or actual clinical experience may encourage a student to reflect on their practice. Furthermore, this feedback need not be from educators only. Vicarious experience, obtained through observing others, assessing their practice and providing peer feedback, can be a useful strategy in assisting students to develop competence in clinical skills (Zulkosky, 2009). Kearney and Schuck (2006) reported that not only did peer evaluation result in a shared experience, student motivation was noted to be higher and they demonstrated a greater interest in the activity. This process promoted a student's self-belief in their ability to perform the same skill – the belief that “if they can do it so can I” (McConville & Lane, 2006).

Students who are engaged in a task that combines practice and feedback, are more likely to develop self-efficacy of their own practice (Manojlovich, 2005). Self-efficacy refers to the conscious awareness of self-ability that a student possesses (Bandura, 1977). Self-efficacy can be promoted with personal experience of a situation or task and can be enhanced with training and repetition (McConville & Lane, 2006). Zulkosky (2009) expressed how demonstration followed by the opportunity for practice can enhance self-efficacy. Cheraghi et al. (2009) believed that measuring a student's self-efficacy can assist in predicting clinical performance, as poor clinical performance may be indicative of low

levels of self-efficacy and not just poor clinical skills. Evidence to support this is provided by Manajilovich (2005) who links high levels of self-efficacy to more advanced professional standards and practice, and Zulkosky (2009) who believes self-efficacy is associated with the ability to tackle challenges and demonstrate confidence in decision making.

The literature is replete with information on diverse instructional approaches designed to optimize student learning and its transfer to other settings. Technology has extended the possible approaches, in particular the affordances of video technology shows promise (Das & Alliex, 2010a; Hands et al., 2010; Kearney & Schuck, 2006; McConville & Lane, 2006; Preston, 2008; Rich & Hannafin, 2009).

An advantageous feature of video medium is its ability to provide a life-like learning experience. Kearney and Schuck (2006) encourage the use of digital video as a means of providing an authentic learning experience, where classroom experiences have real life relevance to the student. The possibility of authentic video experiences to engage students more effectively in their learning has been shown by Kearney and Schuck (2006) who suggest that students become more enthusiastic learners than evident in standard class tasks. It seems that video analysis can be a potent learning tool in transforming the learning experience from passive to interactive, and thereby maximising the engagement of students (Preston, 2008). Furthermore, this may occur because video recorded performances can be less daunting than practicing in front of a large peer group (McConville & Lane, 2006). In particular, a study by Das and Alliex (2010b) involving nursing students showed that video analysis provided a learning strategy that was less anxiety provoking than classroom demonstration of clinical skills. Likewise, Hands et al. (2010) supported these findings in studies evaluating video technology with sports science students.

The reduction of stress in the learning environment through the use of video technology may facilitate processes of learning. McConville and Lane (2006) identify that the availability of a video recording means students can view the performance on several occasions in order to assess and evaluate a task, particularly if the task is complicated. The time to review a video supports a student's reflection on their performance or that of others (Hands et al., 2010; Rich & Hannafin, 2009).

The promotion of reflection is a key component of authentic learning (Herrington, Oliver & Reeves, 2003). Rich and Hannafin (2009) reviewed the use of video analysis in teacher education and concluded that there was potential for the process to encourage reflection, and provide a means of measuring the impact of self-reflection on development. Likewise also in teacher education, video was used by Preston (2008) as a stimulus for reflection on performance and to evaluate if the opportunity to self-reflect leads to an improvement in the student's confidence in the skill level. The findings suggested that students are more thoughtful in their critique of their performance when

using video for reflection. In nurse education, Gordon and Buckley (2009) demonstrated the effectiveness of videoed simulation sessions in improving skill level in clinical care. Study participants positively rated the experience of being able to review their performance via video and found the reflection encouraged debriefing, a finding supported by Rich and Hannafin (2009) who reported that collaborative discussion had great benefit to students. Hands et al. (2010) found that students learnt through the feedback that emerged through using video technology with their peers.

There is considerable support for the use of video analysis in the learning environment, particularly to develop clinical skills, yet there is little empirical evidence to determine if video analysis has any impact upon a student's self-efficacy and their ability to transfer this knowledge to the clinical area. Whilst Das and Alliex (2010b) claimed that video review led to reduced student anxiety and increased confidence in the students perceived competence level, there is little on the use of video as a vicarious, interactive process to enable a student to develop their self-efficacy.

This pilot study within the School of Nursing and Midwifery at Curtin University sought to determine if video analysis can be used to develop and enhance self-efficacy, whilst exploring its impact on the learning process and student satisfaction. Specifically the use of video technology was applied to the learning of a clinical based psychomotor skill requiring its later application in the clinical setting by nursing students. The video analysis technology utilised in the study is *CRITIQUE*, described later.

Context

This project introduced and evaluated the use of a video analysis learning strategy for second year undergraduate nursing students or equivalent graduate students enrolled in a nursing practice clinical preparation unit. The students were practicing clinical skills for application in their first hospital based clinical placement. Prior to this project, the learning strategy employed to prepare students for clinical practice included the demonstration of skills by a nurse academic in a clinical laboratory setting followed immediately by supervised rehearsal and practice by the student. Further opportunity to rehearse skills prior to clinical practice was not provided. Assessment of skill performance occurred within the clinical practice setting under the supervision of clinical educators.

The pilot study intervention included the traditional preparation in conjunction with an additional learning strategy prior to the commencement of clinical practice. This strategy involved an opportunity for skill practice in a second laboratory with the difference that the intervention group were required to digitally record themselves or their peer performing a clinical skill in the laboratory setting. Once the skill was recorded, the students constructively analysed the performance using a video analysing program called *CRITIQUE*.

Research questions

The project was guided by the following research questions:

- What impact does video reflective learning analysis have on students’ self-efficacy for performing a psychomotor clinical skill?
- Is video reflective learning technology an effective learning strategy?
- Is a video reflective learning experience sustainable for large group teaching in undergraduate university courses?

Technology

The software program *CRITIQUE* was used in this study. This program is a video critiquing application that was developed for application in university teaching in the Health and Sports Science areas (Hands et al., 2009). *CRITIQUE* requires a recorded video to be stored on the Web as the program uses the Web address to access and import the footage into the program. Students ‘bookmark’ sections of the recorded footage using numbered ‘buttons’. Bookmarking inserts markers on the digital video that permits the identification of a particular section of the recording. This section can then be assigned an analysis code and played back at will. *CRITIQUE* places markers on the video by clicking on ‘buttons’ to mark the start and end of the segment of interest. Once the markers are assigned, the program allows the insertion of text comments adjacent to the assigned section. Students were encouraged to reflect on the recorded skills performance and provide both positive and critical feedback on performance in the text related to bookmarked sections of video footage. Once the student has finished their analysis and coding of the video they were requested to share it with others. This allowed them to review both the recording and their peers’ feedback. The end result after coding is a video with numerous markers placed within it, and a text based code to explain their placement, see Figure 1.



Figure 1: *CRITIQUE* Platform, illustrates the video footage on the left of screen, the coloured marker buttons on the right of screen and the student comments assigned to each bookmarked section below the video footage

Uploading student videos to the Web poses problems with regards to privacy and security. The use of readily available means of uploading via *YouTube* was deemed

unsuitable due to the public availability of the recorded video. These concerns were overcome at the University by use of the Curtin iLecture system to upload the video recordings. This password controlled environment is Curtin University’s digital audio and video storage and retrieval system, used for the recording, compressing, storing and accessing of lectures.

Once the clinical skill recording is manually set to upload by the tutor into the iLecture system, the Web link is automatically emailed to the tutor. This Web address was then forwarded to students who inserted it into the *CRITIQUE* program. Students were provided with a step by step guide using computer screenshots to demonstrate the insertion of the Web address into the *CRITIQUE* program. Once the address was inserted the students were able to view their video and commence analysis.

Project methodology

The project used a quasi-experimental study design, involving a convenience sample of pre-registration nursing students ($N = 90$) to determine the impact of the video learning experience. All students were enrolled in a unit of study where instructional strategies are designed to support specific nursing clinical skill development. One skill set was selected from those in the unit syllabus for review in this study; the aseptic set up of a dressing pack was selected due to the relative simplicity of the skill and ease of recording for trailing the technology.

A two group pre-test/post-test design used random sampling based on students’ pre-programmed laboratory attendance for the unit. Equivalent intervention (I) and control (C) groups were formed ($n = 45$) and the study conducted between July and November, 2010. Participation was voluntary and non-participation did not affect the student’s progress in the unit. Ethical approval was granted by the University Human Research Ethics Committee.

Students were required to attend the regular two hour laboratory session, which involved modelling of the skill by a nurse academic followed by coaching, as students rehearsed the aseptic dressing set up. At the end of the laboratory all students were asked to complete a pre-questionnaire, which was then posted anonymously into a secure University internal mailbox. Questionnaires administered to the intervention group were marked with an “I” for linking pre-data to post-data.

Four weeks after completion of the laboratory session all students were invited to attend a second practice laboratory. The control group repeated the experience encountered in the first laboratory session, whilst the intervention group were required to record their performance whilst practicing the skill. The intervention group were assigned to a group comprised of three students; one student elected to perform the skill, another to record and a third to offer constructive advice on the skill performance. Students used their own

recording devices, including mobile phones and digital cameras. Recordings were supplied to the academic staff for uploading onto *CRITIQUE* via the iLecture system.

Within two weeks the intervention student groups were provided access to their respective video footage on *CRITIQUE*. Once accessed, the groups were required to engage in reflection whilst critiquing the performance. To guide the reflective practice students were provided with a purpose designed rubric identifying key elements of the skill; in particular, hand washing, coordination of performance, maintenance of asepsis and duration of procedure. During the reflective process the identification of strong and weaker aspects of the performance were encouraged and students entered comments describing these aspects directly into the video critique programme. The groups were allowed two weeks to complete this reflective learning activity, whereupon it was submitted to the academic for review. Following the reflective activity, students in both study groups were asked to complete a post-questionnaire, which again was posted anonymously into a secure internal mailbox.

Purpose designed pre and post questionnaires were developed for the study. The pre questionnaire consisted of two parts, Part A collected demographical data, including the student's age, gender and student residency status (domestic or international). Students were also asked what lab preparation they had undertaken: lecture, laboratory information available on the unit's Blackboard site, other or no preparation. No identifiable data was collected. Part B assessed self-efficacy and comprised two questions: self-confidence and perceived ability to perform the skill; it used a 6-point Likert scale from '0' strongly disagree to '5' strongly agree. The post questionnaire duplicated Part A, with the exception of the preparation question and Part B, with the addition of a third Likert scale item assessing perceived improvement in the skill. In addition, two other parts were included for completion by the intervention group only: Part C consisted of items using the same 6-point Likert scale and assessed the learning affordances of *CRITIQUE*, these were support of: learning processes (4 items), reflective practice (3 items) and application to clinical practice (1 item), and overall satisfaction with learning experience (3 items). In addition, the platform's capabilities assessed were user's information technology (IT) skills (2 items) and time commitment (1 item) to manage *CRITIQUE*. Part D included four questions; one question used categorical data to estimate time spent using the learning strategy and three open-ended responses to ascertain students' opinions of advantageous and disadvantageous features of using the video learning experience and additional feedback. Part C and D were informed from a survey used in previous related studies using technological aids in teaching and learning (Lee et al., 2010).

Results

Of the 90 students invited to participate in the study, 58 completed the pre questionnaire (C = 17, I = 41) and 25 the post questionnaire (C = 14, I = 11); the response rate being 64.4% and 27.8% for the control and intervention groups respectively. The lower

response rate post-intervention needs to be taken into account in the interpretation of the findings.

Table 1 details the characteristics of the study participants. To establish equivalency of the groups parametric (*t*-test) and non-parametric (Pearson’s Chi-square) tests were conducted; there were no statistical differences between the control and intervention pre-groups and post-groups on age, gender, course level and student status. Given the respondents in the pre and post phase could be different subjects, equivalency testing was repeated to identify if demographical differences existed in the pre and post groups; no statistical differences were noted: age ($p = .382$), gender ($p = .590$), course level ($p = .374$) and student status ($p = .876$).

Table 1: CRITIQUE’s Learning Capabilities

	Pre-groups (<i>n</i> , %)			Post-groups (<i>n</i> , %)		
	Control	Intervention	P value	Control	Intervention	P value
Age	<i>M</i> = 24	<i>M</i> = 23	0.786	<i>M</i> = 24	<i>M</i> = 20	0.750
Gender						
Males	3 (17.6%)	4 (9.8%)	0.401	1 (7.1%)	1 (9.1%)	0.859
Females	14 (82.4%)	37 (90.2%)		13 (92.9%)	10 (90.9%)	
Course level						
Undergraduate	12 (70.6%)	30 (76.9%)	0.615	12 (85.7%)	9 (81.8%)	0.792
Graduate	5 (29.4%)	9 (23.1%)		2 (14.3%)	2 (18.2%)	
Status						
Domestic	11 (64.7%)	34 (82.9%)	0.130	10 (71.4%)	9 (81.8%)	0.546
International	6 (35.3%)	7 (17.1%)		4 (28.6%)	2 (18.2%)	

Note: Pre-groups demographics - 2 students did not record their course level.

Impact on perceived self-efficacy

Following the first laboratory session, where the skill was taught, students in both the control and intervention group felt reasonably confident and believed they were equipped with the skills to perform a dressing set up procedure, see Table 2. Although the control group was more confident and the intervention group believed they had greater skills, neither difference was statistically proven using *t*-test analysis. Post intervention the ratings for confidence and belief in skill performance were also lower for both groups. Whilst the intervention had slightly higher ratings than the control group on both of these items no statistical differences were evident.

Table 2: CRITIQUE’s impact on self-efficacy

	PRE-GROUPS			POST-GROUPS		
	M (SD)			M (SD)		
	Control	Intervention	<i>P value</i>	Control	Intervention	<i>P value</i>
Self-confidence	4.06 (.83)	3.93 (1.06)	0.648	3.71 (1.20)	3.73 (.78)	0.976
Perceived skills	3.29 (1.05)	3.38 (1.06)	0.792	3.07 (1.44)	3.18 (.60)	0.814

The findings for perceived confidence and ability to perform the skill were explored further using percentage from the students’ agreement ratings on the Likert scale. It was seen that data from the intervention group trended towards improvements in confidence and perception in skills ability. Conversely, the ratings declined for the control group, see Figures 2 and 3.

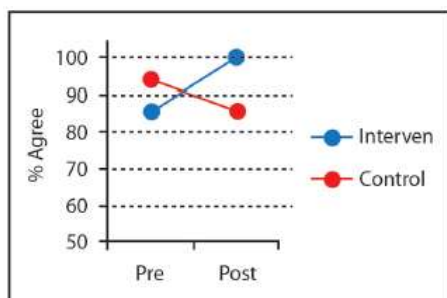


Figure 2: Students self-confidence ratings

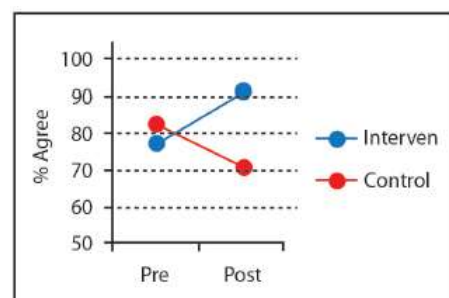


Figure 3: Students perceived skills ratings

Effectiveness of learning strategy

As can be seen in Figure 4 the use of *CRITIQUE* had a favourable impact on learning. The overall satisfaction rating for this method of developing clinical skills was high ($M = 4.03$, $SD = .67$) and users’ felt it supported reflective practice ($M = 3.88$, $SD = .97$). The higher ratings of 4 or 5 on the Likert scale indicated strongest agreement and were particularly evident for the three items used to assess reflective practice; these items provided insight into the influence of the video learning experience on: evaluating personal skills (63.5%), determining strengths and opportunities for development (72.8%) and ability to perform the clinical skill (54.6%). Although the reflection on clinical skills is lower than the other two aspects, overall this item was rated agree to strongly agree by 100% of the students.

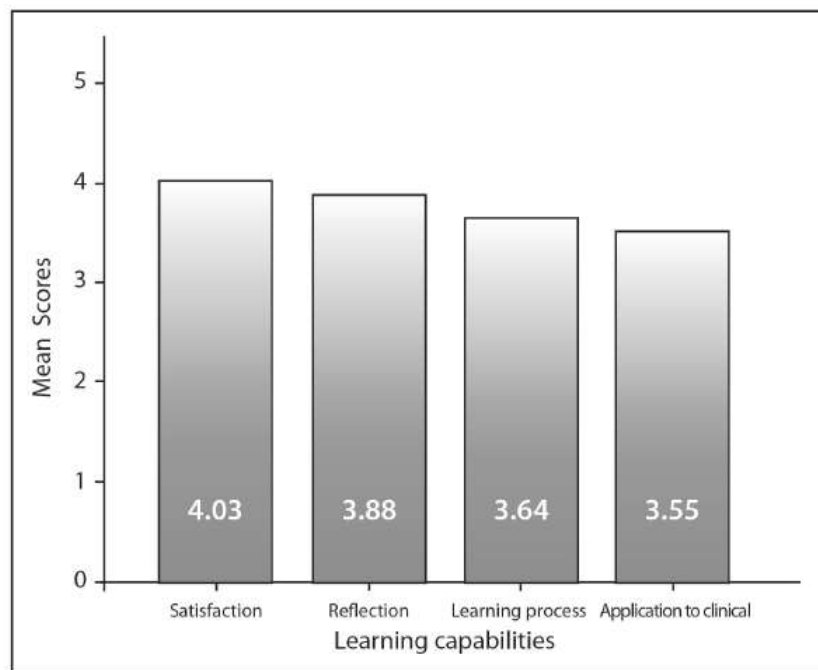


Figure 4: *CRITIQUE*'s Learning Capabilities, assessed using a Likert scale of 0 “strongly disagree” to 6 “strongly agree”

The learning processes category included four items ($M = 3.64$, $SD = .66$); all performed well: effective learning (72.8%), motivation (63.7%), independent learner (63.7%) and understanding (54.6%). Although the impact of the technology on perceived support in preparing for clinical practice ($M = 3.55$, $SD = 1.12$) rated lower than the other 3 categories, it was still regarded positively. In summary, the intervention group reported greater perceived skills in the technical performance of this skill ($M = 4.00$, $SD = .89$) compared to the control group ($M = 3.86$, $SD = 1.23$); however, this was not statistically different ($p = 0.75$).

Qualitative responses provide insight into why students viewed *CRITIQUE* positively. In particular students indicated their learning was enhanced because *CRITIQUE* allowed them to repeatedly review the video, objectively assess a peer's work and review the reflection of other peers. Despite this students felt that an exemplar recording showing the correct application of the technique would facilitate learning, allowing students to reflect on their own performance in comparison to the exemplar.

Sustainability of CRITIQUE

The student users perceived that the level of technical skills required to use *CRITIQUE* ($M = 3.32$, $SD = 1.33$) was reasonable and generally within their capability. Further, its use was not arduous, with students indicating the time commitment required to use *CRITIQUE* manageable ($M = 3.82$, $SD = .98$). However, qualitative responses from students indicated that the *CRITIQUE* editing system was difficult to use and problematic if the quality of the original recording was poor as visibility of the skill performance in *CRITIQUE* was hindered. The time for uploading videos into the

University iLecture system was problematic. The uploading proved to be a time consuming for the tutor. Devices such as an iPhone® were in a compatible format (video file) for the iLecture system, while non-compatible files from other cameras had to be converted.

Discussion

The results from this study indicate the potential benefits of the inclusion of *CRITIQUE* into pedagogical practices used to develop nursing students' clinical skills. In particular the program appears to effectively support reflective practice, which was shown by others to be a salient educational feature of video technology (Hands et al., 2009; Preston, 2008). The strong positive responses by students indicating the exercise helped them to understand the principles behind the skill may indicate the learning activity stimulated critical thinking about their performance – “The fact you can see more objectively the pros and cons of your technique . . . ” (student comment). The positive trends shown by the intervention group for confidence and perceived skill level are encouraging and indicate the value of a wider reaching study. This is especially relevant given students felt the experience helped them prepare for clinical practice and is therefore congruent with evidence from Gordon and Buckley (2009). Given the prevailing limitations in clinical placements the use of video interactive technology should support improved preparation prior to applied practice, maximizing the time available for the real world experience.

Overall, students in the intervention group indicated that the experience was worthwhile. They indicated a high level of satisfaction and enjoyment gained from the experience, which is consistent with the findings of Das and Alliex (2010a) in their study involving nursing students. In particular it seems students felt the time investment for the task was reasonable, similarly supported by Das and Alliex (2010a) in their pilot study using the same video program.

The technological skills required to use *CRITIQUE* were generally seen as non-threatening, with students believing they already possessed the necessary information technology skills to successfully use the program. However, reported problems, predominantly related to the creation of Web addresses for the video, have also been noted by others (Das & Alliex, 2010b; Hands et al., 2009). To avoid IT issues being seen as a disincentive to *CRITIQUE*'s use the technological aspect of installing video footage into *CRITIQUE* needs to be overcome. At Curtin, this can be overcome by direct automatic recording onto the iLecture system. Some of the available clinical laboratories are equipped with video recording facilities directly linked to the Curtin University iLecture. Using this style of recording would also improve the video quality and enable a Web address of the stored footage to be automatically e-mailed directly to the students for use in the video analysis software. Furthermore, when the laboratories are available the students could book into a laboratory and record skills at a time convenient to them.

The limitations of the pilot included the low post survey response rate. Accessing students during their scheduled laboratory times encouraged response to the pre-test questionnaire; however this was not feasible for the post test which may explain the reduced number of questionnaires returned for analysis. The low number of control group responses may have been due to a lack of engagement by those students who were not part of the intervention. If the study was repeated it is recommended the recording session takes place earlier in the semester to allow greater contact with students to prompt them to return questionnaires. Alternatively, questionnaires could be made available via an online survey service which could be linked through the unit Blackboard site. Santos and LeBaron (2005) indicate that online survey mechanisms can often result in a lower respondent rate. Other strategies could be taken to improve the response rate, for example a recent online questionnaire resulted in respondent rates in excess of eighty percent when students were encouraged to complete a paper-based questionnaire during scheduled teaching time (Stanley & Glaister, personal communication, December 12, 2010). A further limitation of the pilot was the small number of participants. If the study was to be repeated choosing a larger student sample size would increase the opportunity for more statistically significant findings.

Conclusion

This project studied a group of nursing students and examined the impact of video analysis of a clinical skill on student self-efficacy and its acceptance and value as a learning tool. Preliminary findings from the pilot study are favourable. Although analysis showed no significant statistical difference between the self-efficacy ratings of the intervention and control group, positive trend data suggest its potential. The results from this pilot study correlate with other studies involving video analysis in student learning. In summary, students were provided with an authentic learning experience that was viewed positively by both staff and students.

The evidence produced support the expansion of this pilot study to a larger study. Prior to this it is recommended that the implementation difficulties in storing of videos on the Web be overcome. Further study will demonstrate if this approach has a statistically significant impact on the students' preparation for clinical practice.

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<http://youtu.be/QD0yf0iRozk>

A blended approach to supporting student learning in clinical microbiology laboratory classes

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KEYWORDS

Clinical microbiology,
video display, microscopic
images, macroscopic
images

Abstract Traditional approaches to teaching clinical diagnostic microbiology utilise a gradual but repetitive regime of exposing students to working with and identifying various bacteria growing on artificial culture media. It was anticipated that the addition of a two camera video display system, utilising two 65 inch plasma televisions, into the microbiology laboratory would successfully enable a greater number of organism to be covered in a shorter period of teaching time. One of the main objectives of the system was to improve the ability of the students (n=52) to differentiate between potential pathogenic and non-pathogenic bacteria based upon the colony morphologies of the organisms on various culture media. 94% of the students agreed that their ability to recognize potential pathogens growing on agar media was improved by using the system. 100% of students agreed that the video projection system was a positive addition to the microbiology laboratory and 100% agreed that using the system during practical classes enhanced their learning of the material in the course. 90% feel that a similar system would be useful in other microbiology units they have studied. The system successfully enabled a content rich syllabus to be taught in limited period of time.

Background

Medical scientists are the health professionals who work in diagnostic pathology laboratories performing diagnostic assays on all types of human biological samples. They provide test results and their interpretation to medical practitioners. The Laboratory Medicine course offered at Curtin University is one of 11 undergraduate degrees available in Australia and New Zealand that is accredited by the Australian Institute of Medical Scientists (<http://www.aims.gov.au/>).

One of the primary disciplines that students study in preparation for a career in diagnostic pathology is clinical microbiology (the study of microbial disease, the laboratory diagnosis of infection and treatment). The etiological agents of infection can be subdivided into four key areas; bacteriology, parasitology, virology and mycology. While students are introduced to all of these topics at Curtin the major emphasis at the undergraduate level is in the area of bacteriology. One of the most challenging aspects of

bacteriology, in the context of the laboratory diagnosis of infection, is acquiring the ability to recognise and differentiate the growth characteristics of potentially pathogenic bacteria from that of the non-pathogenic normal flora, from any given body site. This is made more complex by the fact that some members of the normal microbial flora, both from inside and outside of the body, can themselves, be pathogens when they acquire entry to sterile sites or are transferred to a body site that they normally don't inhabit. Add to this that a range of different agar culture media is used to ensure the recovery of various types of organisms from various body sites, then the process of bacterial recognition and differentiation is made more complex for the student because the growth characteristics of various bacteria can differ considerably from one type of agar to another. So not only do students have to differentiate pathogens from non-pathogens, based upon growth characteristics and taking into account the bodily site of collection, but they also have to develop the ability to do this across various culture media.

The traditional approach that has been used to accomplish this training during the second year of the course is to initially provide *pure* cultures of known pathogens and non-pathogens growing on various culture media to individual students and get them to record a comprehensive set of growth characteristics and colony features. Over the course of 10 practical classes during a semester (one practical per week), the students could expect to encounter about 20 different organisms in this manner (i.e. two different organisms per week) with another 10-15 organisms provided as demonstration items. In the subsequent semester students would begin to process and examine cultures of these same organisms *mixed* together on various culture media according to specimen and body sites. The students would get to process and see most of these organisms for a second time during this semester. The areas of parasitology, virology and mycology were also introduced during this period. At the completion of second year those students wishing to major in clinical microbiology would then proceed to study for a further two semesters before the completion of their degree. For those not choosing microbiology as a subject major, this would be the end of their microbiology training.

In contrast to the traditional approach outlined above, recent changes to the structure and composition of the undergraduate degree have meant that second year students now only receive a very basic introduction to clinical bacteriology where they get to process and identify only five different pathogens. Those that choose to major in clinical microbiology at the end of second year, now only undertake one semester of intensive clinical microbiology training, in the first semester of third year, before commencing two semesters of laboratory-based work placement, including a six week placement in a microbiology laboratory. The present challenge is to cover as much of the traditional and essential bacteriology, together with the basic elements of parasitology and mycology condensed into a single semester, so that the students are adequately prepared to embark on their microbiology field placement.

The primary use of a blended learning approach in the current context of clinical microbiology education was to enhance student learning with respect to their ability to recognise colony morphologies of both pathogens and non-pathogens growing on

artificial culture media. These skills and competencies are normally acquired by repetition over a substantial time period, owing to the complexity of studying a large variety of micro-organisms, each of which may require a different set of skills (Sancho et al., 2006). Blended learning is particularly suited to this aspect of clinical microbiology education since the provision of online resources combined with the traditional face to face delivery is a strategy that reduces in class time in the face to face environment (Lorenzetti, 2011). Some of the repetition required to develop skills can be provided through the availability of online resources and/or exercises that can be accessed by the participants according to individual need, whenever required.

In practice, while it is relatively easy to provide uniform cultures of individual bacteria to every student in a clinical microbiology course, it is very difficult to provide consistently similar mixed cultures across a class or classes. Even though mixed culture plates are normally prepared from a single broth culture containing two or three bacteria, there are always a number of the replicate cultures where one organism outgrows the other or due to the ratio of the numbers of one organism to another, one or both of the colonies do not grow to their normal size. One of the recognised benefits of blended learning is the uniform delivery of the information to each student (HRWorkbench, 2011). The ability to display culture results to a whole group of students simultaneously was seen as a way to alleviate the problem of culture variation as well as promote group discussion about the reasons why culture variation occurs, even though all agar plates are inoculated from the same stock culture.

While the presumptive identification of some bacteria can be made based on their culture morphology, the presumptive identification of many others will require the correlation of their culture characteristics with their microscopic features. Therefore, an additional perceived benefit of introducing blended learning to the microbiology classroom was the ability to use the technologies to display and record microscopic images of the micro-organisms analysed during the laboratory sessions. While various authors have published articles concerning the use of virtual microscopy in the fields of pathology and histology (Grossman & Grossman, 2008; Maybury & Farah, 2010; Merk, Knuechel, & Perez-Bouza, 2010; Paulsen, Eichorn, & Brauer, 2010; Schmidt et al., 2011), to date no literature could be found describing the use of such technology with a focus on teaching the recognition of bacterial colony morphologies and their associated microscopic findings. In fact, the only reference to blended learning in clinical microbiology education that this author could identify was the successful application of virtual laboratory exercises to achieve learning outcomes in two microbiology units from a pharmacy course in Spain (Sancho et al., 2006).

While the identification of micro-organisms did form one of the six virtual laboratory modules conducted at the University of Salamanca, there is no indication about how many of these micro-organisms were bacteria and there is no indication what role if any, colony morphology played in the identification process (Sancho et al., 2006). It can be

deduced that at least some of the micro-organisms in the course must have been bacteria because the students were required to interpret Gram staining results (a bacteria specific staining process) from microscopic images (Sancho et al., 2006). There is no mention of whether the students were required to interpret culture characteristics of the bacteria included in the course. However, this seems most unlikely given that none of the students performed any hands-on laboratory work as part of the identification module they engaged in. Therefore, an assessment of the likely beneficial role of blended learning in the identification and recognition of bacterial growth characteristics on common culture media remains unreported.

Photographic image collections of bacteria growing in culture do exist on the internet (e.g., <http://www.microbiologyinpictures.com/index.html> and <http://www.asm.org/Division/c/library.htm>), however these are limited in their detail and scope. The extent of the images available is limited to certain common bacteria and these are often only presented on limited types of culture media, like blood agar (e. g., <http://www.microbelibrary.org/component/resource/laboratory-test/2881-blood-agar-plates-and-hemolysis-streptococcus-and-other-catalase-negative-gram-positive-cocci>). In the current course of study, the students are expected to gain an understanding of what the various organisms look like on a variety of culture media including, but not limited to, blood agar (BA), BA with colistin/nalidixic acid (CNA), Mueller Hinton agar (MH), MacConkey agar (MAC) and chocolate agar (CHOC). Therefore, a course specific photographic collection was deemed essential and is one of the recognised benefits of blended learning (HRWorkbench, 2011).

A further limitation of photographic images, irrespective of their source, is their static nature. Unlike the examination of real culture plates where the viewer is able to tilt the plates in the ambient light, they do not allow the view of the three dimensional nature of the colonies. One of the intended benefits of our blended learning approach was to capture video footage of the plates being manipulated to reflect light from the surface of each culture, thus providing far more detail about the nature of the colony morphology compared with static images found in text books or on the internet. While video footage demonstrating particular bacterial colony morphologies may well exist on the internet, none could be found as individual files. Some such footage may exist as embedded material within more extensive microbiological education presentations.

With as many as 35 different bacterial organisms being presented either individually on different types of agar, or in combinations of two or three bacteria mixed together at a time on different agars, the complexity and the amount of detail that the ab-initio student has to grasp within a limited time frame is overwhelming, but essential. Within the limited time frame available, it is not possible for every student to obtain 'hands-on' experience with every organism. Therefore, the ability to simultaneously display and discuss colonial morphologies with an entire class during practical sessions will not only ensure uniform delivery of the information but will ensure that every student has

exposure to all of the organisms. In addition, the ability to capture the images and create an online reference library will allow the students the flexibility to 'practice' and review the material whenever required or desired. A further advantage of the latter is that the visual library created will be specific to the strains of bacteria and the working environment/conditions under which the students actually process them.

The over-arching aim of the current study was to incorporate appropriate audio visual technology into the clinical microbiology laboratory that would positively influence and assist in facilitating the learning of a content rich curriculum in a condensed period of time. The specific aims were: 1) to improve the ability of students to identify pathogenic bacteria from non-pathogenic bacteria, based upon colony morphology; 2) to determine if the laboratory video projection system positively enhanced student learning during the course, 3) to determine whether online resources prepared from recorded material from the laboratory sessions were a useful means of assisting with learning and preparing for the practical exam, and 4) to investigate student attitudes towards the use of traditional hands-on materials and virtual images.

The technology was implemented in time for the first cohort of students to undertake this new microbiology unit within the newly structured course during semester one of 2011.

Approach

Participants and unit structure

All of the laboratory medicine students enrolled in Medical Microbiology 331 (MM331) at Curtin University in the School of Biomedical Sciences during semester one of 2011 participated in the study (52 undergraduate students). Prior to commencing this microbiology unit, the students had to have achieved a pass in the prerequisite unit, Medical Microbiology 235, which they undertook during the first semester of 2010 (completed nine months previously).

The prerequisite unit of study only provides an introduction to the laboratory skills utilised in diagnostic clinical microbiology. As such, the timetable for the delivery of MM331 content was structured to accommodate an intensive lecture program during the first four weeks of semester. The first introductory laboratory class was not scheduled to commence until week two of semester, with the first detailed hands-on exercise scheduled for week three. This facilitated the presentation of three one hour lectures prior to the commencement of the first introductory practical exercise, the delivery of a total of six lectures prior to the commencement of the second practical and a total of nine lectures before practical three.

The lecture topics were arranged so as to provide essential background knowledge to the students before they encountered corresponding material in the practical classes. The topics presented during the first nine lectures in order of delivery included: an

introduction to antibacterial agents, fermentative Gram negative bacilli including extended spectrum beta lactamases, urinary tract infection and specimen processing, the processing of wound and pus swabs, catalase positive Gram positive cocci, catalase negative Gram positive cocci (two lectures), non-fermentative Gram negative bacilli and 'other Gram negative bacilli'. As far as possible, the lectures contained information about the growth characteristics and diagnostic features of all of the organisms discussed therein, including representative photographic images obtained from a variety of external sources (NB: images from this study were not yet available for inclusion in the lectures). The practice of introducing laboratory techniques and organism features during the lectures before the corresponding content was introduced in laboratory exercises was continued throughout the semester.

The total amount of time allocated for practical classes in MM331 during the semester was 30 contact hours or three hours per week for 10 weeks. In previous microbiology units that utilised this time allocation, the three hours of laboratory time was normally split over two consecutive days so that sub-cultures and diagnostic tests could be set up during the first session, incubated overnight and inspected the following day during the subsequent session. However, this format only allows the students to be provided with pre-prepared cultures on agar plates and does not allow sufficient time for the students to culture and perform identifying tests on bacteria contained within simulated clinical specimens. The latter requires laboratory sessions to be conducted over three consecutive days with two incubation periods (nights) in between. For this reason, the 30 hours of allocated practical time for this semester was divided into seven weekly exercises of four hours plus and an introductory exercise of two hours. The two hour introductory session was divided into two one hour sessions held over two consecutive days in week two of semester. The four hours of laboratory time per week was subdivided into a 1.5 hour, 2 hour and 0.5 hour sessions conducted over three consecutive days in weeks 3, 4, 6, 7, 8, 10 and 11. There was no practical scheduled in week five so that the lecture program would remain ahead of the practical program. Week nine was a designated student free week.

Technology

Two 65" high definition Panasonic Viera plasma television sets (model TH-P65S20A, Panasonic, Japan) were connected via two HDMI leads to the two output connections of a 4 x 2 HDMI Matrix Switcher (Model HDMX 0402 from www.ezyhd-cables.com.au/ - which permits 4 different input signals and 2 output signals). Using the matrix switcher, one input signal can be sent to both televisions simultaneously or two separate input signals can each be displayed individually (one per television). The televisions were placed on the side bench of the PC2 microbiology laboratory class approximately 10 metres apart. One of the cables was 15m long and the other was 1m long (both Monster Cable M1000 series - >14.96Gbps, USA). Two Canon Legria HFS21 high definition video cameras (Canon, Japan) were connected to two of the four input channels of the matrix switcher using two mini HDMI to HDMI cables. The video camera output was

of the mini HDMI plug type. One of the video cameras was mounted on a small photographic tripod and was positioned on the side bench of the laboratory so that objects of interest could be positioned underneath the lens (an objective lens distance of approximately 30 cm). The second video camera was mounted to the top of an Olympus BX41 microscope (Olympus, Japan) using a Canon specific MM99 adaptor tube (Martin Microscope Company S/N: 5026, USA). The microscope was fitted with phase contrast rings and the following objective lenses: x10, x20, x40, x100 (non-phase) and x10, x40 phase contrast. The HDMI matrix switcher not only permitted the easy selection of either camera's output as the input source for display on the televisions but also served to amplify and maintain the signal along the 15m length of HDMI cable to one of the plasma screens (a maximum of 25m was possible with the model purchased). The Canon digital video cameras were used to capture both still images (up to 3264 x 2456 pixels) and video footage (1920 x 1080 pixels) on a week by week basis during the practical classes as the semester progressed. Image and video data was directly recorded onto two Sandisk Extreme 32GB SDHC cards (one per camera). These were used to transfer material from the video cameras to a PC for manipulation and long term storage.

Still images (both macroscopic and microscopic) were edited using Microsoft Office Picture Manager on a PC running Microsoft Windows 7. Editing was limited to resizing, contrast, brightness and picture orientation. The images were then incorporated into a series of Microsoft PowerPoint presentations with annotated features and explanatory detail. These presentations were placed onto the unit web site within the Blackboard Learning Management System (version 8.0.494.5, release 8 service pack 7) as they were completed. Video footage was edited using Camtasia Studio 6 (TechSmith, USA). Owing to both limitations in the PC processing power available at the time of project and the time available to edit and process video footage during the concurrent teaching period in which it was obtained, the video footage was stored for future use and did not form part of this project.

Educational procedures with the technology

During the practical classes and on a daily basis, both microscopic and macroscopic footage was displayed in real time to the students as a means of standardising disseminated information. The macroscopic camera was initially used to display bacterial colony morphologies on various culture media. However, it became clear that the ability to display printed charts, tables and documents as well as being able to demonstrate certain laboratory skills was an additional and unforeseen benefit of this system. In the case of the former, the camera was used like a document viewer/projector. In the case of the latter, new laboratory techniques are normally explained with students crowding around a single bench location in the laboratory or they may only be explained in theory using diagrams on the whiteboard. Therefore, the principal benefit of using the camera system to demonstrate laboratory techniques was the unobstructed, close-up view of the procedures being carried out. Examples include the demonstration of the catalase test, the oxidase test, the spot indole test, inoculation techniques, Phadebact *Streptococcus*

grouping, latex agglutination for *Staphylococcus aureus*, bile solubility, interpretation of antimicrobial disc susceptibility testing (CDS and CLSI methods), interpretation of commercial biochemical test strips (API20E, Microgen GN-ID sytem), interpretation of urine colony counts (calibrated loop and filter foot), rapid tributyrin test, rapid PYR (L-pyroglutamic acid β -naphthylamide) and the rapid disc Cephinase test.

Initially, the camera attached to the microscope was used to provide assistance to the students in interpreting Gram stain results. This was especially useful when the students were first introduced to clinical smears containing very small or plump/short Gram negative bacilli such as organisms from the genus *Haemophilus*, *Bacteroides*, *Acinetobacter* and *Klebsiella*. Questions about the 'apparent' ambiguous appearance of these bacteria and the other microscopic elements often found in Gram smears were dealt with by displaying the microscopic appearance of the organisms/object of interest and halting class activities for 1-2 minutes to provide instruction, explanation and guidance. This reduced the need for students to raise their hands and wait for demonstrator assistance (2 demonstrators per 40 students) before being able to progress with the rest of the prescribed practical activities. As a result, this generally improved the efficiency of the laboratory sessions for the students whilst improving staff availability to assist/answer other questions.

Later in the semester, the ability to display microscopic findings was of particular benefit when the students were introduced to the areas of parasitology and mycology. The diagnosis and identification of many infections in these two disciplines are primarily based on the microscopic morphology and features of the causative organisms. The features of a select number of fungi were displayed and discussed as a group before the students embarked on preparing and analysing various cultures of fungal growth individually. In the case of parasitology, there are limitations on the availability of fixed clinical samples containing known parasites, especially the more exotic organisms not endemic to Australia. The camera system permitted all of the students to see real examples of the diagnostic forms of some parasites where only a single stool sample of limited volume containing an organism was available. It was also beneficial to be able to display and discuss the morphology of faecal elements that often resemble parasitic ova but are artefacts.

Microscopic analysis of urine specimens using phase contrast microscopy was also taught using the video display system. The ability to identify, differentiate and enumerate white blood cells, red blood cells, squamous cells, crystals, bacteria and amorphous deposits was achieved using the technology.

Evaluation tools

To determine the effectiveness of the blended learning approach to laboratory learning, the students voluntarily and anonymously completed a pen and paper questionnaire about their perceptions of the audio visual system. The questionnaire was administered

prior to their laboratory practical exam at the end of the semester. The instrument was based on previously published statements (Farah et al. 2010; Maybury & Farah, 2010; Sancho et al. 2006) with adaptations and additional questions related to the specific application of the technology (Table 1). There were 22 questions where the students were invited to provide responses using a 6 point Likert response scale (SA = Strongly Agree, A = Agree, U = undecided, D = Disagree, SD = Strongly Disagree, N/A = Not Applicable). For reasons of clarity, the six point rating scale was merged into a four point rating scale by combining the responses for 'Strongly Agree' with 'Agree' and the responses for 'Strongly Disagree' with 'Disagree' (Table 1). There were two qualitative questions at the end of the survey as follows:

1. I enjoyed learning with the video projection system because....
2. Do you have any other comments you would like to make about the video projection system?

As an indirect measure of the perceived popularity/usefulness of the online image resources (those recorded in the laboratory and placed on the unit Blackboard site), the content usage statistics for the number of 'hits' made to the file containing images of Gram negative organisms during the semester up to and including the date of the practical exam was analysed. This file was available and accessible for most of the semester whereas, the other image files were only compiled closer to the end of the study period. Since all of these files could be downloaded onto private computers for future use, a single hit by an individual student could be just as significant as multiple hits by one individual. The usage statistics for the Gram negative file were categorised as follows: the number of students who made five or more hits, the number of students who made between two and four hits, the number of students who made only one hit and the number of students who did not access the file at any time.

The study and questionnaire was approved by the Human Research Ethics Committee at Curtin University.

Findings

One hundred per cent of the 52 students enrolled in the Medical Microbiology 331 unit during 2011 completed the survey. The responses obtained have been summarised in Table 1. There was overwhelming agreement with most of the statements concerning the benefits and quality of the images obtained using the video system. Four of the 22 questions received responses with 100% agreement (Q1, 2, 4, 20) and 11 questions received responses with between 88 and 98% agreement. These results indicate the video projection system was a very positive addition to the microbiology laboratory (100% agreement) and that the overall quality and resolution of the images was sufficient for the learning of the material (100% agreement). The system positively enhanced the learning of the material in the course (100% agreement) and there was a high level of student satisfaction with the approach used.

Colonial morphology

There were three questions that specifically dealt with the recognition of colonial morphologies on agar culture media (Table 1, Q8-10). The importance of colonial morphology as a means of fast tracking the identification of an unknown pathogen was affirmed with 88% of respondents agreeing that the ability to recognise particular colony morphologies reduced the time taken to determine an identity. Only 6% disagreed with an equal number being undecided. When asked if the images improved their ability to recognise potential pathogenic bacteria, 94% agreed with the remaining 6% undecided. In contrast, when asked if the images improved their ability to differentiate pathogenic bacteria from normal flora, only 79% agreed, 19% were undecided and 2% disagreed.

Table 1: Questionnaire addressing the student's perceptions about the laboratory audio visual system

Item	Agree %	Undecided %	Disagree %	N/A%
1. I feel that using the video projection system in the practical classes positively enhanced my learning of the material in this course?	100	0	0	0
2. Overall, I found the quality of the images and video materials to be sufficient for the learning of the material?	100	0	0	0
3. The resolution of the microscopic images was sufficient for the learning of the material?	98	2	0	0
4. The resolution of the macroscopic images (agar plates, colony morphologies, demonstration items etc.) was sufficient for the learning of the material?	100	0	0	0
5. I feel that the video projection system will positively affect my grade for this course?	96	4	0	0
6. It was <i>often</i> necessary to use both the projected/virtual images together with actual hands-on laboratory materials during the semester to understand the material?	88	10	2	0
7. I preferred looking at the actual hands-on laboratory materials to the projected/virtual images?	54	23	23	0
8. The ability to recognise particular colony morphologies reduces the time taken to determine the final identification of an unknown organism growing in culture?	88	6	6	0
9. I feel that the images of colony morphologies improved my ability to recognise potential pathogenic bacteria growing on agar media?	94	6	0	0
10. I feel that the images of colony morphologies improved my ability to differentiate between potential pathogenic bacteria and normal flora growing on agar media?	79	19	2	0

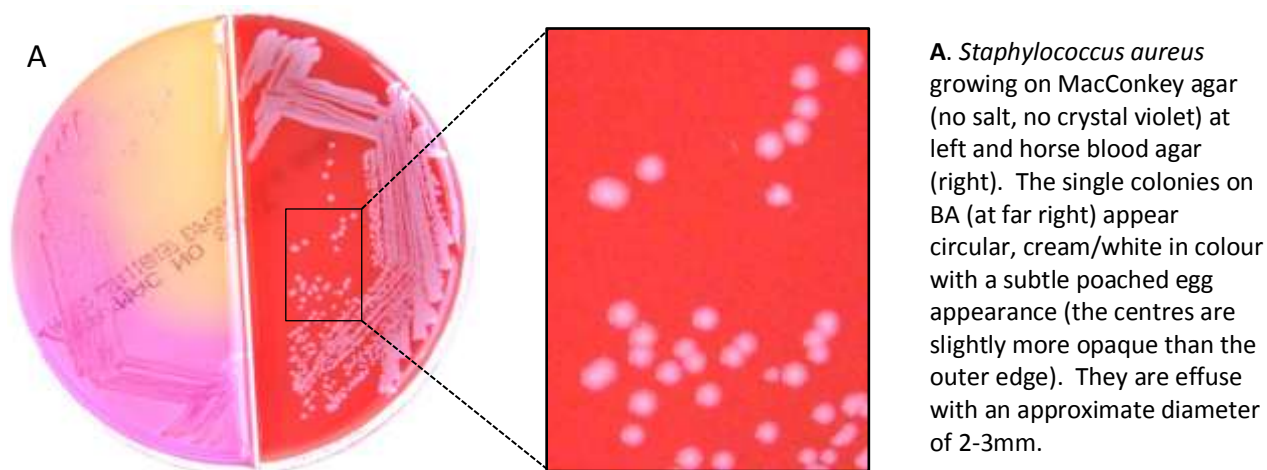
Item	Agree %	Undecided %	Disagree %	N/A%
11. The ability to share results and observations with the whole class using the video projection system enhanced my learning of the material in this course?	90	2	2	6
12. The ability to share results and observations with the whole class in practical sessions, allowed for greater collaboration with other students?	77	19	0	4
13. The <i>microscopic</i> images were more useful than the macroscopic images of agar plates, colony morphologies, demonstration items etc.?	37	38	25	0
14. The <i>macroscopic</i> images of agar plates, colony morphologies, demonstration items etc. were more useful compared with the microscopic images?	54	29	17	0
15. The online resources in Blackboard positively enhanced my learning of the material in this course?	98	0	0	2
16. It was relatively simple to use Blackboard to interface with the resources derived from the video projection system?	90	6	2	2
17. Using the materials from the video projection system OUTSIDE scheduled laboratory class time helped me to understand the material?	75	6	4	15
18. Using the video projection system DURING scheduled laboratory class time helped me to understand the material?	98	2	0	0
19. I found the online resources useful for preparing for the practical examination in this course?	96	4	0	0
20. I feel that the video projection system was a positive addition to the microbiology classroom?	100	0	0	0
21. I feel that the video projection system would be useful in other microbiological courses that I have studied?	90	8	0	2
22. I consider the online images from the video projection system of little use unless supported by the hands-on materials and exercises in the laboratory sessions?	54	29	17	0

These latter results indicate that the majority of students were generally able to differentiate pathogenic bacteria from non-pathogenic organisms that were mixed together on semi solid culture media. Of the 21% of students that did not 'agree', the fact that 90% of these students were 'undecided' suggests that these students may not

have fully identified or connected the question with the particular laboratory exercises that were conducted to facilitate this outcome. Alternatively, while they could recognise this learning outcome embedded within the laboratory exercises, the exercises themselves were either insufficient in frequency or insufficient in clarity to fully achieve the learning outcome. Overall, the video system was very effective in conveying the importance of colonial morphology in the laboratory identification process and it greatly improved the ability of the students to recognise potential pathogens.

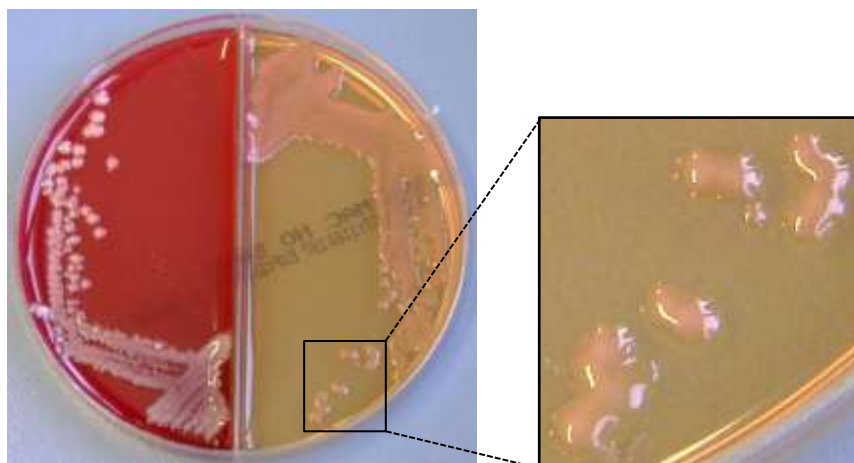
Image and video quality

Four questions within the questionnaire dealt with the student's perceptions of the quality of the images (Q3, 4) and the relative merits of the two cameras used in the imaging system (one for microscopy and one for culture plates and other macroscopic materials, Q13, 14). There was 98% and 100% agreement respectively that the resolution of the microscopic and macroscopic images were of sufficient quality for the learning of the material. Examples of the colony morphology detail and information regarding the image sizes being displayed are shown in Figure 1. When asked if the microscopic images were more useful than the macroscopic ones, 37% agreed, 38% were undecided and 25% disagreed. Similarly, when asked if the macroscopic images were more useful than the microscopic images, the responses were divided (54% agreed, 29% were undecided, 17% disagreed). This suggests that both types of images play an important role in the learning of the material with the macroscopic camera judged slightly more useful than the microscopic system. This finding is in agreement with this author's observations of the two cameras. Although both camera systems were utilised during the laboratory sessions, the macroscopic camera system was definitely used more frequently than the microscopic system. The macroscopic camera was not only useful for displaying colonial morphologies of bacteria growing on culture media (as intended), but was found to be extremely useful for displaying all manner of objects, for demonstrating rapid test procedures, reading biochemical test results (Figure 2) and for displaying printed tabulated data (similarly to a document reader/display). Based on these results it is reasonable to assume that regardless of a student's seating position within the laboratory, relative to the two plasma screens, the image quality was of a sufficiently high standard.



A. *Staphylococcus aureus* growing on MacConkey agar (no salt, no crystal violet) at left and horse blood agar (right). The single colonies on BA (at far right) appear circular, cream/white in colour with a subtle poached egg appearance (the centres are slightly more opaque than the outer edge). They are effuse with an approximate diameter of 2-3mm.

B



B. *Klebsiella pneumoniae* growing on BA/MAC as above. The single colonies on MAC (at far right) appear pale pink in colour with a shiny, wet, mucoid appearance (pink means the organism ferments lactose in the media). They are convex and have a very sticky consistency. Individual colonies are circular and have an approximate diameter of 3-5 mm. However, they often coalesce with surrounding colonies to produce large irregular areas of growth.

Figure 1: Examples of the colony morphology detail that can be displayed/captured using the video display camera system. The petri dishes measure about 9cm across (actual size). In photographic mode, the native resolution on the cameras produces a static image where the petri dish is about 50cm in diameter allowing close-up detail to be shown. In the laboratory, the petri dish fills the entire screen of each of the 65" plasma screens.

Figure 2: Photographic image of two agar slopes (triple sugar iron agar – left, urea slope – right) that were inoculated and incubated as part of screening a faecal specimen for the presence of *Salmonella sp.* and *Shigella sp.* The actual tubes are approximately 10cm long and 12mm wide. The native resolution of this image was 2277x925 pixels and produced tubes that were about 70cm long. When orientated sideways, they can be displayed in real time using video mode to completely fill the screen of the 65" plasma screens in the laboratory.



Using the resources in and out of class

Given that the video display system was used primarily in laboratory classes to display materials in real time and that there were also static images placed online as study resources, a series of questions were posed to determine the students' perceptions of the relative usefulness of the online materials compared with those displayed during laboratory classes. Firstly, 90% of the students agreed that the online resources were easily accessed/utilised (2% disagreed, with the remaining 8% either undecided or nominating 'N/A'). Ninety eight per cent of the respondents agreed that the online resources positively enhanced the learning of the material in the course. The remaining 2% nominated 'N/A' to this question. Ninety six per cent of the students found the online material useful in preparing for the practical exam (the remaining 4% were undecided). Interestingly, when asked 'if using the materials from the video system outside of laboratory classes helped to understand the

material', the number of students who agreed dropped to 75% with 15% nominating 'N/A', and 6% undecided. The reference to 'outside' of laboratory classes was meant to imply the use of 'the online material' as opposed to students having free access to the laboratory video system for their own study purposes. It is unclear if this question was misunderstood. The question was intended to identify whether there were more people who found the online material more useful than the material presented during the laboratory classes. The latter is certainly not true, given that 98% of the respondents agreed that using the system during class helped them to understand the material with only 2% undecided. While the overall positive feedback from these questions supports the use of supplemental online resources derived from the laboratory video system for private study, it is equally clear that using the laboratory system during class is an integral part of the student's learning experience. Ninety per cent of the students agreed that sharing laboratory results and real time observations with the class, using the video display, enhanced the learning of the materials, while 77% agreed that it allowed greater collaboration with other students.

Hands-on materials and virtual images

It is this author's opinion that virtual images and recorded video could never fully replace hands-on learning in clinical microbiology at the level being taught. Nevertheless, three questions were included in the questionnaire to investigate the students' attitudes towards using the virtual images compared with using real life hands-on resources (Table 1). Two of these questions invoked reasonably split responses (Q7 and 22). When asked if the 'hands-on' materials were preferred to the virtual images, 54% agreed, 23% disagreed and 23% were undecided. Similarly, 54% agreed that the online images were of little use unless supported by the 'hands-on' materials, 17% disagreed and 29% were undecided. In each case, the majority agreed that the 'hands-on' materials were important. What is interesting is the relatively high number of students that were undecided on whether one system was more useful than the other. It is tempting to interpret these 'undecided' responses as being from those students who place an equivalent emphasis on both 'hands-on', face to face teaching together with the utilisation of virtual resources. When asked 'if it was often necessary to use both types of resources during the semester to understand the material', 88% of the students agreed (Table 1, Q6). Therefore, it is clear there is a role for both approaches in clinical microbiology education and that the utilisation of virtual resources could not be fully substituted for the 'hands-on' laboratory training.

Blackboard usage statistics for online resources

Although the students were asked about their perceptions regarding the usefulness of the online resources in the questionnaire (as described above), the actual number of times each individual student accessed the 'Gram negative bacteria' file on Blackboard was examined. This group of bacteria represents a very large component of the course and the online file summarising all of these organisms was made available as soon as the

material was compiled, following the first two to three weeks of semester. The total number of times the file was accessed on a day by day basis from the time it was first made available (March 14th, 2011) until the end of June, 2011 is shown in Figure 3. There was a total of 76 ‘hits’ during the first 7 days of availability. As expected, there was quite a bit of activity in the 7 days up to and including the practical exam (26th May, 2011). There was 164 ‘hits’ during this time frame with only 10 of these on the actual day of the prac exam. Between the first day of availability and the practical exam, a total of 356 ‘hits’ were made to this file. Given that 4 of the total of 52 students did not access the file at all during this time, this equates to 7.4 ‘hits’ for each of the remaining 48 students. A breakdown of the frequency with which students accessed this file is shown in Table 2. The majority of students accessed the file 5 or more times each (61.5%) with 17.3% accessing it between 2 and 4 times each. Clearly the students’ positive perceptions regarding the online material, as indicated in the questionnaire, were based on actual and repeated use of the resources. Even though the file could have been downloaded to a personal computer by any of the students (constituting a single hit), it would seem that most preferred to access the file from Blackboard, on demand, when required.

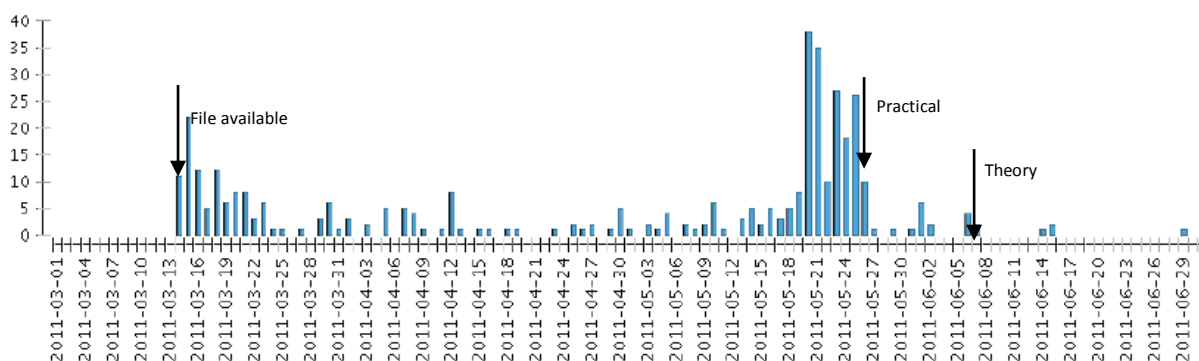


Figure 3: Graphical representation of the number of ‘hits’ (y axis) made by students to the Gram Negative file located on the unit’s learning management system website (Blackboard) versus the date (x axis). The file was first made available on Blackboard on the 14th March. The practical exam was held on the 26th May and the final theory exam was held on the 7th June. There were 356 ‘hits’ made to this file from the 14th March, up to and including the day of the practical exam. There were 17 ‘hits’ made to this file from the day after the practical exam, up to and including the day of the theory exam. Four ‘hits’ were made after the final theory exam

Table 2: The frequency with which individual students accessed the image file of Gram negative bacteria on Blackboard between the 14th March and the 26th May, 2011

Number of students with 5 or more ‘hits’	32	61.5%
Number of students with 2-4 ‘hits’	9	17.3%
Number of students with 1 ‘hit’	7	13.5%
Number of students with 0 ‘hits’	4	7.7%
Total number of students	52	100%

Student comments

There were two questions at the end of the survey that permitted the students to offer further feedback about the video imaging system. Most respondents recorded a comment to at least one of the questions. The following are some of the statements made.

'It allowed us to see good quality images inside and outside of class, and made recognising different types of bacteria easier'

'It allowed me to view different types of organisms without necessarily having to have done the lab. work on every one'

'I viewed every organism made available to the class even though I didn't physically see all of them'

'Easier to show results when viewing macroscopic cultures'

'All bacteria culture plates could be seen without having to crowd around a bench'

'I got to see all the colony morphologies with the demonstrator explaining the defining features'

'Easier to see' 'Very productive' 'You could see more organisms'

'Easy to see colony morphologies which are an essential part of this course'

'Gives a greater learning opportunity, better understanding of the material'

'It enabled the class to view many species of bacteria in the limited amount of time available'

'Even if I didn't get a particular pathogen or bacteria, I was able to see it on the screen'

'It allowed everyone to observe the same thing at the same time, rather than bunching and crowding around an item waiting for other students to finish looking at it or pass it around'

'It saved time and the group learnt as one. We were all able to see the images and identify morphologies'

'It's really great to have the video projection system because it makes learning easier and exciting'

'The university should fund this to be used in all microbiology units, as it would hugely enhance the learning of the material in all classes and aspects of microbiology'

'I can see what organisms other students had'

'It provided better resolution images and demonstrations than that of a text book. Was engaging as well'

'The images are clearer than on a data projector'

'It made a lot of the pathogens clearer and easier to identify'

'It was new and awesome!!'

It is very clear from these comments that the students liked the video projection system. There were no negative comments received. A recurring theme throughout the feedback was that the system allowed for a greater number of organisms to be covered during the course and that the system adequately allowed colony morphology features to be shown, discussed and learnt. It is also clear that the students did not feel disadvantaged if they did not see or process a particular organism first hand. Instead, using the system in the laboratory classes together with the online resources adequately compensated for not having physically manipulated a particular bacterial culture. From a demonstrator's point of view, I concur with many of these comments. The system adequately displayed the necessary information and the students readily embraced it.

Conclusion

The feedback and findings concerning the implementation of the video projection system into the clinical microbiology laboratory were overwhelmingly positive. As many of the students' comments indicate, the system allowed for a large number of organisms to be covered during a limited amount of laboratory class time. All of the aims of the project were successfully achieved. In short, the system successfully allowed the students to understand and appreciate the subtle differences in colony morphologies between various different organisms, and this in turn, has improved the efficiency with which students can move from a hypothesis about the likely identity of an unknown pathogen, to selecting the most appropriate rapid/minimal confirmatory tests for confirmation of their suspicions. This is the principal skill of any medical laboratory scientist working in the field of diagnostic clinical microbiology. Therefore the video projection system successfully addressed this learning outcome.

From a laboratory demonstrator's point of view, the system greatly improved 'in class' time management. Frequently, if a student requires demonstrator assistance at their work bench, the question or problem is usually one that the rest of the students will probably also experience or need to ask. By using each of these different occurrences as an opportunity to explain a concept or provide guidance to the whole class simultaneously (via the video projection system), the practical classes ran more efficiently. In many cases, a short interruption to class activity to explain something meant that many of the students then didn't require demonstrator assistance before being able to continue with their exercises independently. This noticeably reduced the number of requests for hands-on assistance and also reduced the student wait time when assistance was required. As a consequence, the demonstrator was generally more available to assist the students in other ways (i.e., replenishing reagents and consumables, providing assistance with microscopy and laboratory techniques, answering theoretical questions) or just being free to talk about microbiology or the lecture content. The ability to place any document,

diagram or table under the camera and have it displayed also saved time during the laboratory sessions. Instead of asking and waiting for the students to turn to a particular page in their manuals, the page could be displayed and the information contained therein discussed immediately. As one of the student comments of the system states, *“it saved time.”*

In this study, 100% of the students felt that the video projection system was a positive addition to the microbiology classroom and 90% agreed that it would be useful in other microbiology courses. Since the equipment is located in a laboratory that is used by other microbiology units, that is now possible. According to the scientific staff (who prepare the materials for the various practical classes), there have been several situations where students who have experienced the system with a different supervisor, have requested that their current laboratory demonstrator turn it on and use it. Obviously, the students have come to appreciate the benefits of its use and now expect it to be used. It is hoped that together with the findings presented here, this sentiment will encourage the investment and implementation of a similar system in the second microbiology laboratory located in the School of Biomedical Sciences.

In addition to the positive feedback reported here, there has been extremely positive and unsolicited feedback from some of the students from this study, who at the time of writing, are currently undertaking their clinical laboratory work placement. They have reported through their work placement supervisors that the Clinical Microbiology 331 unit, in which the camera system was first utilised, has prepared them very well for working in a routine microbiology (bacteriology) laboratory.

The only thing I would have done differently would be to have invested more time investigating AV hardware, their connectivity and compatibility during the planning processes of the project. By the time I began investigating the mechanisms by which a computer could be placed between the camera output and the signal amplifier/plasma screens, the semester was well underway. A computer would have allowed real time editing/capture of video footage and would have solved a minor problem which none of the students have commented about. From a demonstrator's view point, the one notable disadvantage of the current system occurred when microscopy images were displayed. When images from the microscope were displayed on the two plasma screens, the only way for the demonstrator to point out a feature of interest, was to physically walk between the two television screens and motion at the screen. A computer interfaced between the camera and screens would allow the mouse cursor to be used as a pointer. An order for an Apple Mini Mac (has high definition digital input and output connectors as standard) was placed, but the computer did not arrive until the end of semester.

The addition of online video resources should be viewed as the next logical step in developing the blended learning approach in the clinical microbiology classroom. The real time display of colony morphologies during laboratory classes has one major

advantage over viewing the static images made available as online resources. The real bacterial cultures can be tilted to reflect the ambient light from their surface whereas a static image only captures one 'view' of the growth characteristics. Often, tilting the culture in the light reveals far more detail than can be seen in a static image. For this reason, each organism should be filmed on each of the different culture media (at least 30 seconds on each culture plate) and the videos annotated together with narration. Additionally, the demonstration of certain laboratory protocols and methods could be recorded and uploaded for both classroom use and student revision.

According to Grando (2010), one of the benefits of blended learning is that, "when learning environments combine face to face and online delivery, the resulting learning outcomes can be greater than the sum of each form of delivery." It is this author's opinion that based on the students' feedback, this is exactly what has been achieved and demonstrated during this study.

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[eScholar 2011 – Paul Costantino – Case Study Video](http://youtu.be/IMbEWRGckfY)

<http://youtu.be/IMbEWRGckfY>

Use of online video in a first year tertiary mathematics unit

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KEYWORDS

Online video,
mathematical concepts,
visualisation

Abstract The exploratory case study reported here used an action learning approach to examine the impact of online video on students studying a first year mathematics unit aimed at non-mathematics majors. After this intervention, the students completed a written questionnaire to determine their views on the impact of online video material on their understanding. Although most students were frequent users of online video only a proportion viewed the online video material. Two thirds of students who viewed the online video found it useful for visualising and understanding the practical applications of exponential function. The findings of this pilot study are encouraging and provide impetus to repeat the intervention, and develop online video material in other difficult areas of mathematics.

Background

Throughout Australian universities, first year mathematics units are studied by students enrolled in a range of disciplines. The teaching of these units, (called ‘service units’), presents significant challenges to staff. Lecturers and tutors are faced with an increasing diversity of student backgrounds (e.g., language, cultural), career aspirations, mathematical ability, interest and preparedness (increasingly on the low side), large student enrolments and reduced face to face time coupled with increased content. The majority of students are in their first year of university and are adjusting to a changed teaching and learning environment compared with secondary school. The pace is fast and students are expected to master a wide range of mathematical concepts and skills, in some cases the equivalent of two years of senior secondary mathematics content, within a 12 week semester. Some students find the mathematics content difficult, boring and irrelevant. The use of information communication technology (ICT) has the potential to improve students’ academic achievement and engagement.

The increasing diversity of students presents challenges to tertiary teachers when teaching mathematical concepts. Not only do students have varied mathematical education and ability, but diverse cultural, social and language backgrounds. Students also bring with them perceptions of the subject of mathematics as well as their own mathematical ability,

known as 'Maths anxiety' (Taylor & Galligan, 2006). Kajander and Lovric (2005) found that students with negative experiences at high school suffered with confidence in tertiary mathematics and as a result achieved poor results. Much research has been undertaken to determine how much the affective domain affects the cognitive domain, especially in maths anxious students, and ways in which this anxiety can be overcome (Kajander & Lovric 2005; Perry, 2004; Taylor & Galligan, 2006). Some universities perform a diagnostic test on incoming students to determine their level of mathematical knowledge and then advise students on the appropriate mathematical course to take (Kajander & Lovric 2005; Taylor & Mander 2002). Some provide support for students in the way of bridging courses, mathematical review manuals and/or technological packages (Kajander & Lovric 2005; Selden 2005; Taylor & Galligan 2006). Whichever way it is provided it is irrefutable that support that caters for a diverse range of needs is necessary for many students studying mathematics.

The student diversity is magnified in large first year mathematical service units where students are studying for a wide range of undergraduate degrees. The challenge facing each mathematics teacher is maintaining the engagement and relevance of the material to a group of students with a variety of career choices and aspirations. Wood and Solomonides (2008) believe that students of mathematics do not always have a clear idea of their professional use of mathematics, which affects their perceived relevance of what they are learning. This affects their engagement and ultimately their understanding. Once again ways need to be found to adapt the mathematics course being taught to cater for students' varied professional uses and thus engagement.

Students live in a technological world with information constantly at their fingertips. They instantly relate to video screens and online technology. The use of familiar tools such as these may be used to highlight relevance, promote engagement and facilitate a deeper understanding of mathematical concepts (Cretchley, Harman, Ellerton & Fogarty, 1999; Taylor & Galligan, 2006). Students in most first year mathematical service units are given at most three hours of lecturing per week, usually on different topics and concepts, followed by a one or two hour tutorial. For some students, this is not enough time to gain a deep understanding of mathematical concepts. By using technology (such as online videos) and presenting mathematical concepts in a familiar and engaging context, deeper understanding could potentially be promoted (Niess & Walker, 2010). Students can also view/use these technological and visual aids at their leisure and as many times as is needed to become familiar with concepts. The use of online video has the potential to improve academic achievement through visualisation and the provision of practical applications of mathematical concepts (Luk, 2005).

Can the use of technology increase students' engagement with mathematics? Despite searching the literature we were not able to find any published peer reviewed studies in tertiary mathematics settings where the use of online video was evaluated. Tertiary mathematical concepts are more difficult and abstract than that which is found in

secondary school and are taught in a hierarchical manner. Students need to fully comprehend the basics before progressing further. In first year service units, it is difficult to teach concepts and maintain relevance among students from a number of different degrees. The use of ICT gives teachers the opportunity to increase relevance and hence engagement by providing examples of the same concept in different contexts. Students' individual attitudes towards mathematics are more difficult to alter, however, if enjoyment and relevance is increased, perhaps students' attitudes to and perceptions of mathematics can improve. The advancement of technology occurs at such a rapid rate that it seems impossible for teachers to keep up. However, its use gives them incredible opportunities in their teaching. The use of technology in mathematics education needs to be embraced.

The eScholar project reported in this chapter was undertaken collaboratively by the authors. The first author, a science education researcher provided input into the research design (method, data collection and analysis). The second author, an early career mathematics academic was the unit coordinator, lecturer and tutor of the mathematics unit. He provided important contextual information and allowed himself and his students to participate in this research.

The aim of this pilot research study was to implement and evaluate the teaching of a difficult abstract mathematical concept (exponential function) in contexts that would be relevant and engaging to diverse students studying a compulsory first year mathematics unit. Online video (e.g., YouTube) was used to demonstrate exponential function in a visual and engaging format. After viewing an online video, students read accompanying text and solved related mathematics problems. The solutions to the mathematics problems were subsequently discussed within tutorials. This research study addressed the following question.

1. What are students' perceptions of the use of online video material on their engagement and understanding?

Approach

The research method is an exploratory case study (Stake, 2005) of students studying a compulsory first year mathematics unit as part of a science degree in the Faculty of Science and Engineering at Curtin University. An action learning approach (Kemmis & McTaggart, 1998), was used to implement and evaluate the use of online video material on students' interest and understanding of a difficult mathematical concept (exponential function). The primary data source was a post-intervention written survey. The University ethics approval was obtained prior to commencement of the study.

Context

Students from over 24 different science courses within the Faculty of Science and Engineering complete the unit, Mathematics 101, within the undergraduate science

degree. The disciplines from which students are drawn include computer science, multidisciplinary science, secondary education, software engineering, mining, chemistry, physics, biology, astronomy, surveying, geophysics, environmental science, extractive metallurgy, geology, information technology, nanotechnology, computer systems and networks, resources and actuarial science. The unit is offered in the Department of Mathematics and Statistics in both Semester 1 and 2, with enrolments typically exceeding 250 per semester. The aim of Mathematics 101 is to develop students' understandings of how mathematical techniques and applications can be used to model real world problems in their science disciplines.

The syllabus covers the following topics:

- Functions and their graphs
- Limits and continuity
- Differentiation and integration
- Transcendental functions
- Vectors
- Matrices
- Systems of linear equations and solution methods
- Eigenvalues and eigenvectors
- Complex numbers.

The curriculum is delivered in a traditional face to face mode through three one hour lectures and a one hour tutorial per week for 12 weeks. A blended learning approach is supported at the university with students having access to the online learning management system, Blackboard. The Blackboard site provides students with access to unit outlines, recorded lectures (ilectures), lecture notes, tutorial exercises, assignments, online quizzes, past exam papers and solutions, announcements and discussions.

Participants

Three randomly selected tutorial groups from Mathematics 101 in semester 1, 2011 comprising 49 students (35 males and 14 females) participated in this pilot study. A total of 22/49 students (13 males and 9 females) completed and returned the questionnaire, producing a response rate of 45%. The students were aged 17 to 24 years with 86% of aged 17 (27%), 18 (32%) or 19 (27%) indicating that most respondents were teenage school leavers. The 22 students, who were all studying a Bachelor of Science, were from at least seven different disciplines including computer science (4 students) multidisciplinary science (3), actuarial science (3), chemistry (3), geophysics (3), physics (2) and environmental science (1). Three students did not state their discipline.

Research Design

Selection of mathematical concept

Based on having taught and coordinated the unit for three years, the lecturer noticed that students experienced difficulties with several mathematical concepts, including exponential function, complex numbers, integration, differentiation and eigenvalues and vectors.

Exponential function was selected as the mathematical concept to be addressed in this study for several reasons. First, many students enrolled in Mathematics 101 characteristically experience difficulty with this concept. This anecdotal observation by the lecturer is also borne out in Jennings' (2009) finding in pre-unit diagnostic testing of Queensland students who had studied senior secondary mathematics. Jennings found that exponential function was one of three least understood concepts along with integrals and product rule. Second, exponential function is applicable to many science courses (e.g., rate of change in physics, population growth in biology), thus establishing its relevance to a multidisciplinary cohort. Third, exponential function is a relatively highly weighted content component in the final examination, making it a content area likely to impact students' overall achievement in the unit. Fourth, exponential function is taught in Week 7, making it a period when most first year students are likely to have transitioned to the university learning environment and more specifically the teaching and learning processes adopted in the unit. Finally, a search for available online resources to enhance student learning produced mostly text based content materials and mathematics problems, which were not particularly engaging for learners. The search also yielded online videos that demonstrated practical applications of exponential function visually, making this a suitable enhancement to the unit.

Selection of online video material

An initial internet search was conducted for online video that would be suitable for students. Nine potential online videos from *YouTube* and *Google video* were identified. The number of videos was reduced to five based on length (less than 10 minutes), context (science or of interest to young people), and content (level of difficulty and accuracy). The contexts of the online video were distance, bacterial growth, compounding exponential growth, use of natural resources and folding paper from *Mythbusters*. Accompanying text and problems were developed by the lecturer / course coordinator. An independent expert (an international student (and mathematics academic at her university) studying a doctorate in mathematics at Curtin university) checked the online video, text and problems (termed online video material) in terms of conceptual difficulty and simplicity of language. This review process resulted in the length of the supporting text being reduced.

Development and implementation of post intervention questionnaire

A post intervention questionnaire was developed to determine students' perceptions of the use of online video material on their motivation and understanding. The

questionnaire included questions about students' gender, age, science discipline, highest level of mathematics studied, attitude to mathematics, and use and perceptions of the online video material. The questionnaire results were coded and analysed using SPSS (Allen & Bennett, 2008). The analysis of each section is described in the results section below. The questionnaire was anonymous and no students' names or student ID numbers were collected.

Intervention

In Week 6 (the week before the lecture on exponential function) the online video material was made available to all enrolled students through Blackboard. Students were informed about the material in the lecture and via announcement on Blackboard. The lecturer facilitated discussion about the online video material during tutorials with the randomly selected groups in Week 8. The solutions to the accompanying problems were also posted on Blackboard. The students were then invited to complete the post intervention questionnaire in their own time. Students who were absent from the tutorial did not participate.

Findings

Diversity in Mathematical Background

One aspect of diversity is reflected in students' mathematics background. The students' highest level of mathematics is summarised in Table 1. Completion of a range of nine different pre-university courses was reflected among respondents indicating their diversity in mathematics background. This finding supports the premise that students studying this first year mathematics unit are diverse in relation to their mathematics background.

Table 1: Highest level of mathematics studied

Mathematics course	Number of students (n=22)
Mathematics: Specialist 3C/3D (WA)	6
Mathematics 3C/3D (WA)	5
Calculus (WA)	3
International Baccalaureate	2
International mathematics equivalent	2
Applicable mathematics (WA)	1
Tertiary maths course	1
Form 5: Additional mathematics (Hong Kong)	1
Mathematics B (Queensland)	1

Students' Attitudes to Mathematics

In addressing students' perceptions of online video we considered that it was important to ascertain students' attitudes to mathematics. We surmised that if they did not like mathematics, they might also not like online video. To determine students' attitudes to mathematics, students responded to four Likert scale items for each of four categories: attitudes to lectures, tutorials, mathematics and academic efficacy. The scales were from the TOMRA (Test of Mathematics-Related Attitude Survey) (Hoang, 2008). Students circled a number from one to five where one was almost never, two was seldom, three was sometimes, four was often and five was almost always. The responses relating to the four statements for each category were aggregated and the mean calculated. Table 2 summarises the mean and standard deviation for each category.

Further to the descriptive statistics, scale reliability was generated for all the four scales of the questionnaire. To determine the degree to which items in the same scale measure the same aspects of attitudes to lectures, attitudes to tutorials, attitudes to mathematics and academic efficacy a measure of internal consistency, the Cronbach alpha reliability coefficient (Cronbach, 1951) was used, as shown in the presentation of data in Table 2. Scale reliability estimates for different scales range from 0.63 to 0.80 suggesting all the scales of the questionnaire were reliable for use (De Vellis, 1991).

Table 2: Students' attitudes to mathematics

Attitudes towards:	Mean	SD	Cronbach alpha
Lectures	3.88	0.53	0.68
Tutorials	3.80	0.71	0.80
Mathematics	3.94	0.65	0.63
Academic efficacy	3.11	0.76	0.71

Overall, students' attitudes towards mathematics lectures and tutorials were positive. Indeed students were positive towards mathematics in general. They were slightly less positive about their own mathematics ability. Although not reported here, these findings are supported by students' written comments on eVALUate (the university's online unit evaluation system). One hundred and twenty students responded to the semester one 2011 eVALUate survey and their comments were unequivocally positive about the quality of their lectures and tutorials in the mathematics unit.

Students' Use and Perception of the Online Video Material

Students were asked to indicate and explain their use of online video for entertainment and university study. Students were then asked specific questions about the online videos on exponential function. Almost half (45%) of the students who responded to the questionnaire stated they use online video every day while a further one third (32%) indicated they use online video at least once a week, for entertainment purposes.

However, most participants (77%) seldom or never used online video to assist their learning of university coursework. Their reasons included that they did not have time to search for or look at suitable online video. For example students commented:

Sometimes I found it is quite hard to find a good video to assist me in coursework because [there] is quite a lot of video[s] on YouTube and sometimes I have no idea which of the videos I should follow because different teachers have different explanations. It just confuses me.

I have found some good websites but lack time to do any extra work.

Nevertheless almost all (21 out of 22) students stated that they understand concepts better if they are presented visually. Students' comments included:

I am a visual learner. More likely to understand something if I see it rather than hear it.

Graphics can sometimes be easier to understand and remember than just plain words.

Students get a better idea of what they are studying rather than just memorising from the book.

Almost half (45%) of the participants stated they viewed all five videos while five (23%) viewed only some of the videos. The students who did not view the videos cited lack of time or already having understood exponential function as reasons. Several students stated that the online videos were too long. Of the 15 students who watched all or some of the videos, 10 (67%) perceived that the online videos helped them better understand exponential function because of visualisation and the use of practical applications. Their comments included:

I was able to understand the concept better as the videos showed real applications to the concept and I find that putting it into practice in an application, I can understand how the concept actually works.

Seeing exponential growth in real life help[ed] me to understand the concept better.

Videos were useful to understand application of exponential functions.

The practical real life examples give us real life data that we can practically count and double check.

Three students stated that the online video material did not help their learning and two students were unsure. These students commented that the videos were too long (the combined length of the online video was 32 minutes) or that they had already understood exponential function from their previous studies or the lectures.

Discussion

This research examined the use of online video material to support learning in a first year mathematics unit for students studying an undergraduate science degree. The unit is compulsory and is aimed at students who have not studied calculus previously. The

online video presented practical applications of exponential function in a visual way. Normally, students only have access to written text and diagrams from the lectures and their textbook. As found by Jennings (2009) and others students studying first year mathematics have a diversity of mathematics backgrounds. In this study the 22 students who responded to the questionnaire had studied nine different pre-university mathematics courses offered in Western Australia, nationally and internationally. The students also were enrolled in seven different science disciplines. Although the majority of students were teenage school leavers, the diversity of student backgrounds and science disciplines presented challenges in finding relevant online video.

The use of online video has the potential to be engaging and to improve students' attitudes towards mathematics (Niess & Walker, 2010). However, we found that those students who responded to the questionnaire seemed to already hold positive attitudes about their mathematics lectures and tutorials and mathematics in general. The means for each scale was close to 4 (with a maximum of 5 possible). Thus, in future interventions, the selection of online video will be primarily based on increasing students' understanding rather than improving students' attitudes.

Almost all students perceived that they found concepts easier to understand if presented visually. This finding is supported by Luk (2005) who argues that visualisation will improve students' understanding of mathematics, in particular, abstract concepts. Two thirds of the students who watched the online video perceived that they understood exponential function better because of visualisation of practical applications. Some of those students who did not watch the online video indicated that they did not have time to watch it. None of the students referred to technology problems (e.g. lack of access to the internet). Several students who did watch the online video stated that they were too long. The five online videos comprised 32 minutes of viewing time. The first video on distance, in particular, was considered too long and boring. This video of nine minutes will be removed in subsequent interventions so that the total length of online video will be 23 minutes.

Conclusion

In this pilot study, students from a range of undergraduate science disciplines and pre-university mathematics backgrounds agreed that the use of online video that visually demonstrates practical application of exponential function assisted them in understanding the concept. The intervention was limited to three tutorial groups taught by the mathematics academic. Thus the sample consisted of the 49 students who attended the tutorial class where the online video material was discussed. Of these 49 students, only 22 completed and returned the written questionnaire. This was partly because the students were given the questionnaire to complete in their own time. In a subsequent intervention, all students enrolled in the mathematics unit will be invited to participate and the online video material will be discussed in all tutorial classes. Students will also be informed about the online video from the first week of semester. Also the students may

be offered a small incentive to increase the response rate. The use of a single data source limits the reliability of the findings. In future interventions, focus group interviews will be conducted with randomly selected students to determine their perceptions of the use of online video material. In this study, only one tutor (the mathematics academic) participated. In subsequent interventions, all tutors (and their students) will be invited to participate).

This study was a pilot study with a modest intervention. The authors are aware that several weaknesses limit the robustness of the findings. These weaknesses are discussed above with suggestions for improvement in subsequent interventions. Nevertheless, these research findings provide impetus for the intervention to be modified and repeated in the mathematics unit in a subsequent semester.

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[eScholar 2011 – Ian Van Loosen – Case Study Video](http://youtu.be/K0sCrdQlwoQ)

<http://youtu.be/K0sCrdQlwoQ>

Making boundaries permeable: the university experience through the social sciences

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KEYWORDS

Cross-disciplinary boundaries, online technologies, active engagement, learning journeys

Abstract In this paper we reflect on the challenges of developing and teaching two new first-year (intensively inter/cross-disciplinary and online learning focussed) and two third-year units (more traditional capstone and discipline-based seminar/workshops) in the Department of Social Sciences at Curtin University in a time of significant change to both structural and institutional frameworks. We interrogate our discursive understandings of student responses to units which subvert expectations and demand that students become border crossers (often of self-constructed barriers). In describing and analysing several of the strategies used in the spiral development of skills such as persuasive argument, image-word narratives and cultural accounts, and the ways in which online technologies can be deployed to make these strategies possible, we seek to understand the complexities of the demands felt by students (and staff) as we enter the foreign culture of the 21st century university.

The contexts

Seeking to broaden the intellectual and cultural horizons of its students, in 2010 the Faculty of Humanities at Curtin introduced a number of compulsory and elective (almost) Faculty-wide units (subjects) as components of a first-year foundation program for a new 'Super BA' program. Three of the Faculty's five Schools are participating in the new common core program: Design and Art; Media, Culture and Creative Arts; and Social Sciences and Asian Languages. Students are required to take at least eight first-year units spread over two semesters, a communications unit, Engaging in the Humanities (EITH) which comprises different streams for each School, one formally substantive unit from two offered by their own School, and one each from those offered by the other Schools. Students may also enrol in other Faculty-wide units (as they are known, despite the formal non-participation of two Schools). Anne-Marie Hilsdon was given carriage of the EITH unit for Social Sciences and Asian Languages (SSAL), and Joan Wardrop played the corresponding role for the new substantive unit for Social Sciences (another was separately developed for Asian Languages), in 2010 entitled

Culture, Place, Globality (CPG), and from 2011 renamed as Senses of Place (SoP). Philip Moore taught in both units.

Simultaneously, within Social Sciences, we embarked on our most extensive rethinking and reorienting of our program for more than three decades, in other words, longer than the School working life of almost any staff member. In reshaping the Social Sciences program, we were concerned to ensure the coherence of our majors (which newly emerged as Anthropology and Sociology, History, International Relations and Sustainable Development) and the integrity and challenges of each individual unit in the majors. Because all three of us in this eScholar project had been co-teaching second and third year units for some years we played significant roles in the re-conceptualisation and teaching of units at all undergraduate levels during the processes of reconstruction in both School and Faculty environments.

This paper then records and interprets some aspects of our responses to a period of very significant change in both structural and institutional frameworks.

The participants

Our student cohorts in this project include those from two first-year units (nearly 900 students) and two third-year units (Understanding Social Research 311 and Doing Social Research 312) (approximately 65 students). As described above, one of the first-year units (CPG-SoP 100) has been a compulsory unit for students in the School of Social Sciences and Asian Languages, and an elective (of two units offered by SSAL) for students from the other Schools participating in the Faculty of Humanities first-year foundation program. The cohort for the other first-year unit (EITH) has been primarily SSAL students, with some small numbers from other Schools. The third-year units are capstone seminars for the Anthropology/Sociology and History majors within Social Sciences, including varying numbers (7-10) of students whose majors are in other disciplines and who take these units as part of a minor or as electives.

Students bring very varied backgrounds, interests, skill-sets and commitments to these units. For example, the third-year students have often developed considerable out-of-class experience in student guild activities and community work and several had travelled extensively, often on international student exchanges. First and third year students often have significant knowledge of web-based social media though it became clear to us very quickly that the web knowledge of the new students is often based on and limited to specific platforms or programs. Some new students adapt quickly to searching in media beyond Google or YouTube but others, when asked to research by using the University's Library catalogue or other sites such as Google Books, experience considerable difficulty and frustration. The development and transferability of search and research skills in order to produce information-literate students has therefore been an underlying task embedded in the first-year units.

The teaching staff directly involved in the eScholar project have backgrounds in Anthropology/Sociology (Hilsdon and Moore) and History/Anthropology (Wardrop). The first-year units in particular have involved more than a dozen experienced tutors drawn not only from the social sciences but also cultural studies and art.

The rationale

In this pilot project we have focussed on exploring strategies and technologies for teaching and learning in the new first year units within our Department, and on recording the reshaping of the first-year experience of university for students from a diverse range of disciplines across the Faculty of Humanities. In the third year capstone units our strategies and technologies have refocussed consolidation of knowledge from the previous two years, importantly strengthening interrelationships between the skills embedded in our social science degree and the professional workforce.

The initial challenges

The Curtin Faculty of Humanities historically has prided itself on being the most diverse such Faculty in the country. It was inevitable then that the backgrounds of the students involved in the Faculty's common core units would be diverse and, as indicated above, that they would bring different interests, commitments, skills and cultural understandings to the experience.

First-year students at Curtin find themselves at a very large university whose primary constituency is a sprawling metropolitan area, but also drawing from regional areas in the geographically largest state in Australia, and from international sources such as South, Southeast and East Asia, the Middle East and Africa. In the First Year Humanities common core units like SoP international students tend to be concentrated in disciplines such as Design or Journalism. In the third year almost all students were from the Social Sciences yet (as indicated above) their out-of-class experience varied widely.

The differing cultures of the students manifest themselves through their disciplines (from the markedly vocational to the focussed generalist to the intellectually theoretical); cultural origins and educational backgrounds (local and international, urban and rural students); ages (mostly school-leavers, some with Gap Year experience, many mature-age students, some two or three years out from school, others 10 to 40 years away from formal education); and expectations of the purposes of a university education (vocational training, acquisition of portable research, analytical and communication skills, foundational for a range of possible careers).

Some students are from disciplines in which public exhibition and review of student work is integral to the discipline (e.g., art, design, creative writing), some from disciplines which historically have relied on less public exposure, through tutorial participation and presentation (often reluctant) and essays read only by the tutor. Students' expectations of the location of the boundaries between public and private, between modes and locations

of presentation, publication and performance, in units such as those we have developed therefore are widely divergent, leading to substantial tensions for groups and individuals at times.

We recognise too that many local students work part-time, some almost full-time, and some engage in extracurricular community work. University then is not necessarily perceived as their full-time occupation so that they often do not, as in a more traditional pattern, spend most days of the week on the campus, but rather visit only for classes and perhaps for quick side trips into the Library. The university and its campus are not necessarily the central location or activity in their lives outside the home.

We have observed difficulties for many students in making the transition from school or work to university: from being the big fish in the small, comfortable pond whose boundaries are precise and externally defined, they find themselves the small fish in the very big pond where both demands and boundaries are less clear and often frustratingly changeable. They bring with them difficulties in concentrating for long periods of time, practices and habits of greater reliance on the boundaries set by former teachers and tightly-defined syllabi than are demanded at university, difficulties in problem definition and consequent capacities to work independently, and uncertainties, at a time of transition (for many) from childhood to adulthood, about how to respond to the new and the different.

For mature-age students re-entering education after workplace and/or parental experience, accustomed to decision and boundary making and independent goal setting, often with strong views and opinions, the challenges are more often about accepting externally-imposed boundaries or requirements. This we also recognise as an issue about responses to the challenges of the new and the different.

For students in third year units, once the initial hurdles of earlier years have been overcome, we have perceived challenges for many around deepening and strengthening the core skills of reading and analysing text (whether written, visual, ethnographic) and problematising and representing the perceptions, understandings and arguments that result. In the third year, students are engaged in production of their own texts through advanced social inquiry and empirical research. Through this they are challenged to fully understand knowledge production and thereby to dismantle more comprehensively texts similar to those which they have analysed in the previous two years.

For us then, the primary challenge, perhaps particularly in the new first-year units but inevitably also in the third-year units, has been to construct learning modalities which enable students to cross what are often self-constructed boundaries and barriers. We have chosen to do that through an open-edged style of teaching which, wherever possible, *shows* rather than *tells*, and insists on *doing* rather than merely *listening*, which embraces the reality of cross-disciplinary teaching/learning and engages its disruptive and subversive qualities. In the third year units especially, such *showing* is accompanied by a

challenge to students to take over responsibility for their own learning in line with their eventual entry to the professional workforce. At both levels then we aim at active, engaged, deep learning by the students (Knight 2011, p. 68).

Research Question(s)

Our small team asked how we could most effectively use a set of online technologies to assist students at these two undergraduate levels to:

- make the transition to the intellectual and vocational cultures demanded by the university world;
- understand and, where possible, utilise sources and modes of analysis from a range of disciplinary backgrounds; and
- understand, and where possible, utilise a range of representational possibilities.

Approaches and technologies

In developing the new first-year units, our brief was to be as inclusive as possible, to explore the core themes and topics researched and taught in Social Sciences (and, for EITH, also in Asian Languages) and to engage as many staff as possible in the units, introducing both the individuals and the topics to the students. This was achieved by the developers working on the whole 12-week programs as totalities, conceptualising and defining the topics, approaches and focus skills for each week of the programs. Once those detailed maps for the total programs had been developed, the developers negotiated with colleagues from the disciplines to take responsibility for the development and initial transmission (through a live or online lecture and, then for CPG/SoP, through an online interview) of individual weekly topics.

The third-year units, on the other hand, were initially developed in 2007-2008 to replace a range of units, grown organically over a long period of time in the two disciplines of Anthropology and Sociology, with new interdisciplinary seminar/workshops which deliberately focused and interrogated the core concepts and practices of understanding and doing social research. Drawing intensively on student responses to these early iterations, by 2010 we had developed a structure within which active engaged learning was central to our own practices, each of us individually leading specific seminar/workshops (in a classroom where the others were also actively involved), using both small-group and group-of-the-whole structures to encourage differing modes of discussion, and analytical and presentation skill development through substantial content each week. In these units, online learning systems have played a background role, as support structures, while online research techniques have been foregrounded.

The initial parameters from the Faculty envisaged EITH as a compulsory unit in communication skills, primarily involving detailed weekly exercises which introduce specific skills and technologies. In Social Sciences we give primacy to teaching these

skills through substantive content. This unit then was developed to explore the core social sciences themes of human rights and development through the ongoing skills sessions. For SoP, the parameters were determined by the School (SSAL) and Department (SocSci). In curriculum development, the initial theme of the relationships between culture, globality and place was quickly refined to a focus on these issues as articulated through the core idea of senses of place, and further refined to use each of the discipline areas of the Department as the lens for investigation of particular topics.

In both EITH and CPG/SoP units our core online technology was Blackboard, on which each unit had its own site. The internal applications offered by Blackboard enabled us to develop programs around shifting combinations of intensive online and face-to-face interactions between staff and students. Given the large student numbers, particularly in CPG/SoP, we early identified a requirement to explore online technologies that would enable lecturers, tutors and students to be connected in constructive knowledge loops which would facilitate (and, if possible, demand) deep learning rather than superficial glossing of the complex ideas and concepts that underpin both units: we were actively seeking to replicate the intensity of engagement experienced in live classes. During the second half of 2009 a number of possibilities outside Blackboard were identified for us (for example, Elluminate *Live*, and various types of blogging and online content sharing software). When we tested these, none proved to add significantly to our capacity to achieve our objectives, either being unsuitable for our very large numbers, or demanding temporal synchronicity of a type which was unsuitable for our diverse student cohort, or not sufficiently superior to the Blackboard equivalent to warrant the addition to the suite of technologies we would deploy.

We did however choose to use a combination of Curtin's iLecture system (to record live lectures for immediate dissemination through the Blackboard site) and Echo 360 recordings of framing interviews which were the solution we developed in place of live lectures when confronted with more than 700 students in our second semester of teaching CPG/SoP. No lecture theatre at Curtin was available for this number of students, but even if there had been we would have chosen to use an online format. This is because we recognised that a semi-structured interview (conducted and filmed by one of the unit developers, Michelle Barrett) with a lecturer in their study, surrounded by books, papers and artefacts, would provide a more direct and engaging experience for students.

In choosing to work online to a large extent, we explicitly sought to subvert the understandings of the social sciences carried to university by new students and/or from disciplines which have not conceptualised themselves as research-based but rather essentially as vocationally-based, as preparing students for a particular career through the teaching of a narrow skill-set from within that vocation. Our approach was to offer students understandings of the social sciences as inclusive of a very wide range of

techniques and strategies of social research, analysis and representation, which could be transferred across discipline boundaries.

With the assistance of more experienced Blackboard users, and with clear briefs developed both from intensive discussions and from an earlier online learning project (Wardrop, 2001) we focussed on shaping the capacities of Blackboard to achieve our objectives. In particular, we developed a core concept of a weekly online dossier, designed both to engage the students as actively as possible, and to encapsulate and define the topics and skills to be worked through during each week. The dossier essentially is several objects although it has core similarities in both units.

In EITH each online dossier comprises a preview of the social inquiry to be undertaken for that week. Through an integration of substantive content with specific communication skills, the dossier introduces the topic and its associated key concepts, lists key academic readings and relevant skills websites. Dossiers also incorporate a variety of visual materials: images, photographs, Youtube clips, cartoons, book reviews, interviews, lectures, documentaries, and NGO and government websites and reports. Questions were posed in the dossier to stimulate social inquiry around the topic.

In this way the dossier both invites and requires active student engagement. Students have the opportunity to add their own material to the dossier, resources which encapsulate various aspects of the weekly topic from their own point of view. The dossier links students to their online tutorial group in which they can create and build discussion and critique of ideas and dossier resources. Because the dossiers are posted in advance of the weekly sessions, active engagement with dossiers also serves as preparation for the weekly sessions. The dossier invites and requires contributions such as the following:

1. Sharing ideas and resources on a weekly basis;
2. Writing paragraphs and summaries;
3. Student group presentations on each weekly topic (presented face to face and online). These presentations involve use of a variety of visual, nonverbal, oral and written communication modes including role plays and debates; and
4. Online and in-class student reflections on these presentations.

Most assessments, which also include an essay and an academic referencing test, are submitted and assessed online. The group presentations assessed in class provide the catalyst for student online reflections. While dossiers are intended to stimulate and guide investigation, online submission using different types of audio-visual and written resources facilitate greater possibilities for expression, explanation and argument.

In CPG/SoP, the dossier first offers the students the materials for the investigation of the week's topic. It includes background, discussion, keywords and focus questions and

begins with a brief overview of the topic. Rather than a simple or even an annotated reading list, this is followed by a discursive exploration of ideas linked with sources for the student to follow up. We wanted students to understand that in our own research as social scientists we draw on a very wide range of sources and materials so, while every week the sources included some academic reading (papers or chapters which would be accessible to first-semester first-year students), at least one of which would be designated as essential reading, much of each dossier was made up of visual materials (Youtube clips, newspaper cartoons, maps, paintings, music, graphs, photographs, documentaries accessible through the Library, etc.), and of suggestions as to where to find statistics, transcripts of oral history interviews, NGO reports, etc.).

Secondly, the dossier demands active engagement by each student: in pursuit of the aim of having the student engage with the ideas as fully as possible. The dossier requires weekly contributions of several types by each student to their online group (about 20 students in each):

- a) a write-up of their research/reading/viewing/listening from the dossier materials, about 400-500 words, and including drawings, photographs, maps, audio and video clips, and further questions for class discussion. This section of the dossier is used as the basis for weekly in-class (online or live) presentations by individual students as well as providing further materials for class discussion; and
- b) a reflective online blog/journal in a private space, accessible only to the individual student, the tutor(s) and any other student granted specific permission by the writer. This also includes the full range of visual, aural and written materials and is designed to assist in the development of individual reflective practice.

All assessment for these first-year units is submitted and assessed online, with the exception of assessment for formal in-class group or individual presentations and for class discussions. Online submission opens up the possibility for all students, whether from a specifically visual background or not, to use and analyse images and sound files, and to explore multimedia possibilities.

In EITH the dossiers and parallel in-class sessions focus on a type of sequential development of communication skills embedded in various knowledge contexts. In each week priority is given to a particular skill contextualised in a substantive content from the social sciences and Asian languages designed to support student completion of specific assessment tasks. Hence, critical thinking about gender and sport identities ('Becoming an academic detective') precedes the session about the construction of an argument ('Making persuasive arguments: Reporting the world'). However, the teaching and learning of these and other skills reappear throughout the semester indicating their unavoidable association but also their spiral development. This approach is also reflected in the management of assessment: the essay, for example is initially submitted as a small skeleton piece, returned with feedback, then redeveloped and resubmitted.

Students' opportunities for engaging, analysing and experiencing various forms of communication are expanded and deepened over the duration of the unit by using different technologies to investigate current relevant social, cultural, environmental political and international issues. In one weekly session students investigate a plethora of different non-verbal (e.g., emotional and other bodily) responses to photographs and other images of bodies ('Working without words'). More conventional communication skills such as developing an argument are presented in innovative ways. Students address climate change issues by evaluating the persuasiveness of three arguments: the lecturer's in their presentation, a comprehensive online climate change report and a website. An online website about 'writing a persuasive essay' provides coaching for students in their tasks. As the unit unfolds it is clear that the learning process is strongly supported by peer learning as students participate in the weekly sharing both on and offline of ideas and resources.

The organisation of EITH as a core unit involving a variety of academic staff from social science disciplines and Asian languages has resulted in students being exposed to lecturers, learning styles and substantive content heretofore exclusively available in specific first year subjects. By exploring common themes of difference, identity and human rights students are engaging with foundational knowledges shared by the social sciences and Asian languages. In explorations of cross cultural difference for example in a session entitled 'Writing Culture', students are asked to locate a photo or picture that best represents the 'Australian face', 'by browsing through magazines, website, photo albums of your friends. It could be an image you have seen in television drama, films or advertisements. You could also draw by using your own imagination.' Students are asked to write a paragraph explaining the rationale of their choice and to take it along with the photo/picture/drawing to their weekly workshop. Through the integration of knowledge production and communication skills development in EITH we aim for a greater understanding of both. Such learning we suggest is enhanced by a blend of technologies.

Paralleling the skills development in the EITH unit, in CPG/SoP students were introduced to further skills such as socio-cultural observation and analysis and its presentation through a range of technologies to audiences of varying sizes. The first of these exercises takes place in the first week of the semester when students are asked to write (and visually illustrate where possible) a 200-word cultural account of a meal in which they participate during the week. We give the students a number of models (initially written by staff members, and now also student examples) and make clear that a meal might be a solitary cup of coffee or a family barbecue, or pizza at 3am after a night out, or a bowl of muesli after a long morning run. At this early stage we ask for these to be posted online within the individual groups but accessible to everyone engaged in the unit, tutors giving advice about resizing image (and sound) files, building on skills which some but not all students already possess.

What concerned us in assessing these is the depth and care with which (self) observation is pursued, and the communication of its analytical representation through evocative words and images. In the models the students read of ways in which a meal is a component of cultural networks of understanding, of relationships between people, family, friends, of political relationships, of the tensions between local and globalised production and consumption, of memory, nostalgia and emotional connection. From the beginning of the unit we ask that students immerse themselves in the meanings of what seem to be simple actions and objects and to develop understandings of how these can be analysed, represented and communicated. We convey, in as many different ways as possible, that we are not interested in what Knight calls “strategic” or “procedural surface learning” (Knight, 2011, p. 68; Case & Marshall, 2004, pp. 609-610) in which students blind themselves to understanding what lies behind a particular task and focus solely on the procedural strategies that will enable a superficial achievement of the task. Rather, we explore what full engagement in learning can mean in this social sciences context.

We now engage this type of cultural-account making several times during the semester, looping the observation, analysis, communication and technological skills, so that by mid-semester students are taking for granted skills that they were initially reluctant to engage. In another form of cultural analysis (for which we have specifically used Powerpoint or its Open Source equivalents such as Open Office Impress) we reverse the relationship between words and images, privileging the images (usually no more than five) and limiting the word count. Calling this the Image-Word Narrative exercise, we ask the students to explore one of the unit's central themes, such as the very broad concept of sense of place, through their own experience, and to produce a narrative which can be viewed by everyone else in the unit.

Here we again confront the hesitations, embarrassment and fears (a word often used in discussion of this by the students themselves) that many have about making their work available to others, particularly their peers, to view, read, critique and potentially criticise. Interestingly, we found this also to be true of the students in the EITH unit as they post and share their ideas and their work. Using the technologies available to us, we (as developers and tutors) engage this as a specific barrier self-imposed by students themselves in a number of the disciplines and fields in our Faculty. Surprisingly to us, the technology itself and the skills required to use it effectively, are perceived by many students as a significant barrier, despite their age-status as digital natives (Bennett, Maton, & Kervin, 2008). That, linked with the fear of being criticised or laughed at, has demanded intensive work both online and in class by the tutors, developing generalised understandings of the distinctions between critique and criticism, often working individually with students to locate points of difficulty and to allay fears. That said, once the initial hesitations have been confronted almost all students have found themselves able to embrace the demands, both technological and intellectual, of the units (Hoskins & Van Hooff, 2005).

We are aware of the presence of these issues across first year units, as new students struggle with the transition to the university culture and its demands and requirements. However, we also recognise that we are constructing these units not only on the self-directed learning model but in accordance with what has become best practice across the social sciences. Rather than models of delivery and passive reception (punctuated by essay writing and tests or examinations), our models demand engagement by students, both intellectually and through self-awareness. In developing their intellectual self-awareness, we are asking students to use their own experience of the world as a tool with which to begin the complex task of wider socio-cultural analysis, whether contemporary, historical, political or geographic.

To reach this level of engagement is demanding of students. Student responses have helped us unpack where (and for some, where not) it has been successful. For a substantial majority, the opportunity afforded by the online spaces to work creatively between the scholarly and the personal, and to do so through the understanding of words, images and sounds as equally authentic forms of text, has proved engaging and seductive. Perhaps surprisingly, the blogs (essentially private journals) have not been the only or even the principal outlet for this production of creative and scholarly interrogation and construction of text. Students have chosen to interpret and extend the virtual potentials of the online dossiers (visible to all students) and the various assignments (such as the cultural accounts and the image/word narratives) in unexpected ways that have provoked unanticipated and productive connections and discussions.

Findings

EITH students in the SSAL stream presented reactions and responses similar to those of other streams in the Faculty. Unlike SoP, which is administered at the School level, EITH is administered at the Faculty level (as a unit of approx. 1300 students), the structure of which has had important implications for student teaching and learning. As indicated above, each of the participating Faculty Schools (SSAL, Design and Art [SODA], and Media Culture and Creative Arts) developed their own specific unit known as a stream. In the overarching EITH structure the SSAL stream (semester 1, approx. 130 students, semester 2, approx. 30 students) was relatively small reflecting the pattern of Social Sciences and Asian Languages enrolments. The teaching mode changed accordingly to accommodate the reduced numbers in semester 2, from a live lecture and two hour workshop to online lectures and two, two hour workshops.

The initial structure of the faculty level EITH unit was perceived by students, tutors and stream coordinators in the Schools as 'two-tiered' bringing confusion. When EITH started in semester 1, there were two student outlines, a generic EITH one generated by the Faculty and a stream one generated by the School (the organisation and design of the SSAL unit has been discussed above). Tutors and students became confused about what seemed to be uncoordinated joint advice from stream coordinators and the faculty unit coordinator. Each lecture comprised two-parts, where the Faculty coordinator presented

generic communication skills development to all students thereby reducing the emphasis the stream lecturer could give to the weekly substantive topic, and thus militating against the desired constructive interplay in tutorials between communication skills and stream content. These arrangements were unpopular with both students and stream lecturers. In addition, tutors reported students were overwhelmed by the variety of technologies and strategies they were expected to learn. Apart from using Blackboard as explained above for this eScholar project, students were expected to use i-portfolio and encouraged to use other technologies such as diigo.

Once initial technological, social and personal barriers were overcome through the work done in tutorials, as indicated above, students enthusiastically participated in most activities for which the dossier was a vehicle. However, as generic faculty assessments agreed upon in 2009 did not include all activities in the eScholar project students tended to give primacy to assessment related activities. In addition, initial confusion at the two-tier system with competing demands may have reduced also the level of engagement.

Increased outcomes for students in learning engagement for SSAL students in EITH could be achieved by implementation of recommendations in the Stream Coordinators Report to Heads of Schools (Hilsdon, 2010, p.1) all of which related to redefining the faculty-school structure of the unit. Firstly a reinstitution of the primary place of Stream interpretations of EITH is necessary to support its organic approach as followed in this eScholar project communication. The report also locates any faculty unit development primarily in terms of cross-stream synergies in a continuing 'bottom up' process. This suggests a redefinition of Faculty Unit coordination as one of support to the various school streams as the cardinal points of design and delivery. These changes would facilitate the development of the inquiry based interactive deep learning and other integral aspects of the eScholar project as explained above.

For CPG/SoP, the unit which has dealt with the greatest diversity and largest numbers of students from across the Faculty, each of the two semesters in 2010 produced a similar curve of student reactions, responses and engagements. Because of the requirement that students enrol in core units in their own Schools as well as in others, student numbers differed substantially in the two semesters (approx.110 in sem. 1/2010, approx. 650 in sem. 2/2010) reflecting a pattern of primarily Social Sciences enrolments in first semester and a very diverse range of backgrounds in second semester. Because of the large enrolment in second semester (and the difficulties both of continuing interactive lectures with these numbers and even of finding appropriate lecture spaces), we made the decision to move from the first semester pattern of a weekly one-hour live workshop and two-hour live lecture (as interactive as possible) to a weekly two-hour live workshop and the online interview introducing the week's topic.

Almost universally, the online interviews have had positive responses from the students, although a small minority have been vocal in requesting a return to live lectures. Student

responses tell us that they appreciate being able to time-shift, watching the interviews at a time of their choosing, and they like the interview format, which, in introducing an element of relationality, is viewed as being more personal than simply viewing a talking head. They also like its concision, most interviews not extending beyond 30 minutes, yet very concentrated. This is a comfortable technology for many of the students.

Specific activities such as the early constructing of a cultural account of a meal (discussed above) and the image-word narrative overall produced vigorous and enthusiastic participation and engagement, as did the weekly dossier and reflective blogging. Many students, perhaps even a majority, initially found difficulties in conceptualising and separating the tasks required, particularly those of writing up the dossier and writing a short reflective piece. Weekly practice and feedback from tutors and, in the instance of the dossiers, other students, overcame these difficulties for most. In setting up reflective blogging, in which the audience was both the self (as a number of students specifically recognised) and the tutor, but not fellow students, we recognised that reflexivity is not well understood by most new students, and that it can too easily become self-indulgent and/or banal, lacking intellectual intent and purpose (Prinsloo, Slade, & Galpin, 2011, p. 32). The work of the tutors in open class discussion and in assisting individuals to move beyond this produced remarkable results. Students used the privacy of their blog pages to interrogate the central theme of the unit – a sense of place – as a theoretical construct, as an issue of personal location and being in the world, as cultural narrative of self, family, suburb, club, school (Espasa & Meneses, 2009). The blog also became a place in which questions could be asked of self and tutor, and a place of connection for the student through the tutor not only to the unit but to the university.

The shock of the new, not least of an intellectually open-edged unit in which there was no single set text, was significant for many students, both those entering university immediately from school and those who had been in the workplace. In our estimation this shock was greater than usually experienced by students new to university. The demand on the part of some students for the types of tight, clear boundaries and structures they had been used to in the school environment, and to be told exactly and precisely what to do at every step, needed to be worked through over a period of weeks by tutors demonstrating less mechanical and linear ways of thinking and doing. On the other hand, from the beginning, many students articulated satisfaction and pleasure at being able to think for themselves and to use their creativity in working with the problems and issues we were raising with them.

Overall, though, most problematic for students has been learning to use the online teaching/learning program Blackboard, and Curtin's associated Campus Pack of add-on technologies. From the reports of students themselves, we identify these difficulties in the following ways:

1. initial confusions about which tool to use for which task, in part an issue of some of the technologies not being suitable for the task (e.g., issues of small group

construction and boundaries, with relatively undifferentiated permissions to read and post; our large numbers overwhelming some technologies);

2. student self-perceptions as digital natives challenged by operating in a new environment (university) and with tools which are not as intuitive as those of the social-networking or gaming sites with which they are more experienced and which internalise as normative; and
3. that unaccustomed sense of discomfort and disruption of pre-existing understandings of their individual capabilities and skills for a few leading to a profound frustration externalised by some as blame for a unit which was taking them away from their real purpose in being at university (particularly a problem for student designers), yet for many others productive of a creative tension which gradually manifested itself (by about halfway through the semester) in their understanding and acting on the permission to explore the intellectual, textual, visual and technological possibilities of the topic that we had been giving from the beginning.

In looking back at our original research questions, we recognise that although we did not succeed completely with every student, and there were some that we lost, we provided significant support in making the transition to the very different cultures of the university. By the midway point in each semester the great majority of students had begun to understand and value the range of sources, modes of analysis and of communication and representation to which we were opening doors for them and were producing work that was engaged, imaginative, analytical and creative, and consonant with the principles of engaged, deep and active learning on which we based our project. In particular, beyond the success of the occasional exercises such as the taxing image-word narrative which demanded concision in both images and words, by the time of the final reflective essay in CPG/SoP, a significant number of students were able to recognise and articulate for themselves the extent to which they had come to be able to identify categories and characteristics, to work between words and images, to develop a working understanding of that elusive word *culture* for which so many had unsuccessfully demanded a precise dictionary definition in the first weeks of the unit, and an equally valuable complementary understanding that in situating themselves in their work and their work in themselves, in becoming *reflexive*, they had been able to reposition their understandings both of the work of being at university and of the links and connections between the local and the global, and the personal and the public.

A further factor shaping our experience with the large first-year units was the size of the enrolment in CPG/SoP and our need for a large number of tutors, several of whom took on very substantial tutorial workloads. This added complexity and, while it worked well, demanded constant interaction between the coordinators and the tutors in order to ensure that everyone was on the same page week-by-week throughout a very challenging semester. It is a labour-intensive activity.

Conclusion

What worked well?

We specifically recognise that no matter how sophisticated or responsive the online systems are, without the valuable contributions of colleagues providing content and engagement through their lectures, and, most particularly, the commitment of the more than a dozen experienced tutors working at the coalface week-by-week, dealing with large numbers of students at the most vulnerable point of their university experience, these units would have been impossible. Very early in their first iterations, we realised that if such cross-disciplinary social science units, with all their nuances and complexities and deliberate lack of neatness of ideas and categories, were to be taught substantially or wholly online to first-year students, a cohort of tutors experienced in first-year teaching and with a strong sense of personal engagement with both whole classes and individual students was essential, and that without which we could not teach the units. While we have provided training workshops and as much support as we could for the tutors before and during each semester, it has been their capacity to engage and support students and to work creatively and constructively in live class and online that have made this project a success.

The processes developed in the third-year units, particularly of a close focus on very specific skills (research, reading, critical, analytic and presentation), clearly articulated, demonstrated and practiced, through weekly three-hour workshop sessions informed by the differing positions of the three staff members, produced lively, informed discussions and very high standards of work. What we found was that there was learner centredness and deep learning through active participation. The third-year units have been excellent examples of how we could hand over responsibility for learning through the creation of independent learners. What we now recognise is that although we were not consciously planning out their engagement in any formal sense with blended technologies (as described, for example, on the Curtin site ctl.curtin.edu.au/learning_technologies/, the knowledges we were bringing from the experiences of conceptualising, developing and teaching the new first-year units were profoundly influencing our choices of teaching/learning strategies for the third year students.

What could have been done differently?

We learnt much from the first year of teaching these units, not least about the logistical and intellectual issues of managing and teaching very large numbers of students from very diverse disciplinary backgrounds. Critically, we learnt that students having committed themselves to particular learning technologies required by the unit, are not only reluctant but justifiably vocal, for example, in their rejection of systems that fail to live up to the promises that are made for them, and are resentful of the wasted time when, after some weeks of the semester, they are asked to shift to another technology.

That was of course also a problem for the teaching staff, and built much resentment which had to be identified and overcome.

We also realised that the development of such first year units is an organic process deriving initially from the knowledge/skills contexts identified by the School offering the unit, and developing in response to the interests and needs articulated by a diverse body of students. Centralised Faculty control of such units, itself an innovative process in our Faculty but requiring a certain homogenisation can be detrimental to the provision of learning processes aimed at here.

Implications for future implementation

We have learnt then that we should only marry teaching/learning requirements to specific online technologies if those technologies are already accessible not only to unit developers but also to large student numbers at the time of development so that they can be stress tested. Secondly, the input of students from early in the development of such units is crucial. Informed and interesting student feedback throughout the process, including in SoP an informal and anonymous survey at mid-semester, has enabled development to be responsive and ongoing.

Implications for future research

In the particular, the EITH and SoP students of 2010 will be the third-year students of 2012. The skills acquisition, information literacy and technological flexibilities that we focused on in the first year units has been designed to influence their progress through the remainder of their university careers: detailed follow up of these students in their final undergraduate year will therefore provide further input to the ongoing development of the first year units. In the general, we continue to fine tune these units, recognising that there is much yet to understand about the crafting of being a university student in the humanities in the 21st century.

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[eScholar 2010 – Joan Wardrop, Phillip Moore & Anne-Marie Hilsdon – Case Study Video](http://youtu.be/KQooJki9xhY)
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Using wikis for effective peer assessment

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Abstract In 2009, Curtin University began offering a Bachelor of Education (Primary) program fully online apart from practicum school placements. At Curtin, the Bachelor of Education course has the same structure and units regardless of whether it is taught on campus, regionally or online. The units match in content and assessment and all use Blackboard as the Learning Management System (LMS). For online students, the LMS is the sole source of unit information, documentation submission of assessments and interactions between the students, the teachers and the content and considerable thought has been given to assisting student development in the use of technology and optimising the likelihood of active engagement. Contrary to initial expectations, not all students were technologically sophisticated. Indeed many students were tentative—frightened that they would break something—and generally nervous about learning technologies. To engage students in the learning process, the decision was made to incorporate a wiki, TypeWithMe, into the group assignment. It was hoped that the wiki would benefit students in their group work and the peer assessments aspect of one of their assessments. The results indicated that even though students had concerns regarding their technological ability, they reported that TypeWithMe was easy to use and assisted in both their group work and peer assessment.

Background

In 2009, the School of Education at Curtin University entered into a partnership with Open Universities Australia (OUA) to become the provider of a Bachelor of Education (Primary) degree. This four-year degree is completed fully online with the exception of the teaching practicum requirements. The units are offered across four study periods of 13 weeks duration. Apart from practicum units (which run in the middle study periods due to school holidays), for each year of study, eight units are offered in two different study periods, meaning that study periods one and three each offer the same set of units and study periods two and four offer another set. This allows students a range of flexibility for choice and timing, even though two units per study period is considered a full time study load. The first cohort of enrolments across four units totalled 900 students. This initial large enrolment took staff by surprise, but the exponential growth of

the course over the next six study periods, saw the enrolments climb to over 5000 enrolments in one study period. The speedy growth of the course presented many challenges to those responsible for course management.

As this course is offered through OUA, there is open access to students for six of the eight first year units. Students from all states in Australia and internationally were attracted to the course and some units in particular attracted enrolments of over 2000 students. These students come to study from a variety of backgrounds that are not necessarily typical of a first year university student cohort. Many have not studied for a long time, some have left school before completion of Year 12, some are in full-time work and looking for a career change, some have English language issues and in terms of the skills necessary for negotiation of Blackboard and an online learning environment, most are technologically inexperienced.

Curtin University employs part-time tutors who act as a human interface between the university and its students. Each tutor is responsible for a group of approximately 75 students, giving content specific support for learning through a Blackboard site designed to encourage collaborative learning. Although recent literature discusses whether students are learning about technology or learning through technology, there is strong evidence that the integration of both is what leads to success. According to Salmon (2003), this combination needs to occur with and through interactions with other people. The teacher of any classroom, whether it has solid walls or is virtual, has much influence in shaping the learning environment and outcomes and carries the responsibility for creating the conditions that encourage a deep approach to learning which demonstrates a dynamic and interactive 'community of inquiry' (Garrison, Anderson & Archer, 2000). From the teachers' perspectives this means that they have pedagogical skills and content knowledge that allow them to manage a learning environment that develops and encourages students to think critically and to learn both independently and collaboratively. From each student's perspective, this requires higher-order cognitive processing that includes critical thinking and self-direction (Garrison & Archer, 2000).

Although studies have suggested that the ideal number for online tutorials is less than 25-30 (Anderson, 2004; Arbaugh & Benbunan-Finch, 2006), at Curtin, this ideal teacher/student ratio of 1:30 is not supported by economic reality. For this online course the tutorial groups have a student ratio of 1:75. These tutorial sizes of 75 students are something the course designers, tutors and students have to work with and around, but they do present an area of concern about how tutors are to maintain effective contact with their students and how to ensure that tentative students who are shy about using online communication mechanisms are not lost in the sheer weight of numbers. The staff involved in the teaching program chose to address this through the use of Web 2.0 applications that could be used to carefully introduce students to the concept of self-regulated learning, where the balance between teacher-directed learning and learner autonomy extends not only to the networked learning environment, but also to

assessment (Drexler, 2010). Once again, however, a challenge is created for staff. On one hand there is the formalized and structured LMS which guides students through weekly tasks and readings in much the same way as a face to face class would do and on the other, the desire to encourage students to learn through their interest in a developing community of practice (Wenger, 1999) where effective learning can be encouraged and developed.

Lecturers involved in this program agree with Rogoff's (2001) research which suggests that effective and deep learning occurs when instruction is focused on collaboration. Indeed collaborative learning and working in teams is recognized as a key competency for students (Guo & Stevens, 2011). Collaborative learning is different from cooperative learning. The former involves a concerted and coordinated effort to solve a problem, and the latter involves division of labour with each person taking responsibility for only part of the project (Roschelle & Teasley, 1995). Unfortunately, the formalised learning encouraged by the use of Blackboard promotes a focus upon learning as an individual and is targeted upon individual achievement at the expense of both collaborative and cooperative modalities. The challenge was to seek out technologies that would support collaborative learning. Staff acknowledged some areas of concern. They believed that there was some risk that students may become guarded and possessive about sharing material perhaps because they are used to the competitive nature of schooling. Students had to be encouraged to come to an understanding about the processes of online learning that can be geographically, intellectually and socially isolating.

Young and Norgard (2006) identified that students are likely to become more comfortable and more satisfied with online learning as their experience of the medium grows, suggesting that it is incumbent upon course designers to seek ways of increasing the opportunities for interaction and allowing students to adjust to the particular idiosyncrasies and benefits of this style of learning that requires some technological expertise. Whilst there is discussion that delivery through technological processes allows for varied access to learning materials, there are also claims that the technology is merely a vehicle to deliver the instruction rather than an actual influence on student achievement (Murphy, Penuel, Means, Korbak, & Whaley, 2001). The mandated use of the LMS within Curtin University means that course designers must seek out ways to engage online students in ways that do not merely become a poor cousin of face to face teaching and learning.

Seeking out technology support that is not merely an add-on, but will enhance student approaches to active participation and reflective practice was our biggest challenge. The chosen technology also had to 'fit' pedagogically with the aims of the unit and the course overall, as well as enabling (and not dis-abling) group work and peer assessment. Topping (1998) defines peer assessment as "an arrangement in which individuals consider the amount, level, value, worth quality or success of the products or outcomes of learning of peers with similar status" (p. 250). Within this study, students were asked not to assess

content, but rather to reflect on the value of the peer group in solving the assessment problem and producing a piece of work, the content of which would be evaluated by their tutor. We decided to use Boud, Cohen and Sampson's (1999) definition of peer review. It lists four components that our assessment design enabled students to engage in:

- Students work together to plan, engage in teamwork and become part of the learning community in which they have a stake;
- Reflection and exploration of ideas become more possible when the teacher is not an immediate presence;
- Students practise communicating in the subject area. They become used to peer critique and can adopt a reciprocal role;
- A group of students takes collective responsibility for identifying their own learning needs and how these might be addressed. This activity is a 'learning how to learn' skill as well as providing experience in learning how to cooperate with others.

As Boud et al. (1999, p. 414) remark, most sources of comment on peer review tend to be limited to its use as an instructional strategy for subject matter learning, the result of which may be reflected in examination results. We were more interested in exploring a path which might lead to the creation of community and authentic assessment. In addition, the pragmatism of initiating a process in which tutors were neither necessarily visible nor required by students was attractive in a massive online unit. We were also mindful that group interaction and cooperation is more likely where the tutor is not a constant presence (as noted above).

As the research participants were all first year students, we were wary of having them assess content. However, we wanted to send a message that we value working in groups that demonstrate cooperation and commitment. Boud et al. (1999) comment that although peer assessment has not been highly regarded in the literature, activity within a course is valued for the contribution it makes towards formal assessment. The challenge was to design a mechanism for peer assessment which students and staff saw as valid, transparent and worth effort to initiate.

This study describes the results of the impact of the chosen technological practice (that is, the wiki TypeWithMe) and its interaction with student attitudes to group work and peer review. The research questions investigated were:

1. What were student thoughts on using the wiki?
2. How did the use of the wiki influence student attitudes to group work?
3. How did the use of the wiki impact on student attitudes towards peer assessment?

Approach

This research investigates one large first year unit within the online Bachelor of Education, (Primary) degree that ran in study period two of 2010 (31 May to 27 August). There were 2320 student enrolments, divided into 31 groups of 75 students with one tutor supporting the learning of each group. For many staff as well as students this was their first experience of online learning.

Newcomers to online learning face particular difficulties: many are new to study, many are tentative about embarking upon a new endeavour and many are very nervous about their capacity to succeed. We realised that a number of students, though attempting formal assignments, were not active on the Discussion Board either to discuss their learning or to post responses to their weekly readings and tasks. Our challenge was to attempt to introduce a community of practice through easy to use, flexible, intuitive and free technology in a setting where all students would have an opportunity to participate. We saw an opportunity to introduce this through an evaluative process.

We recognised assessment as another area that deserves attention in an online environment. Although quizzes had been suggested as a tool to measure understanding, we agreed with Palloff and Pratt (2009) who advised that online quizzes and tests may not serve students or instructors well and cite Milam, Voorhees and Bedard-Voorhees (2004) who suggest that as the paradigm for online learning is different, the methodology for assessing that learning should be different too. Peer review and assessment seemed to offer an instructional strategy which would engage all students and be instituted through small group activity.

Teaching and Learning Activity

The assessment exercise had its genesis in a reflective journal encompassing work which was completed weekly by all students. They were asked to discuss their views before engaging with materials and then again after content engagement. The assignment was creative in both content, choice of subject matter and mode of presentation, and therefore lent itself to group collaboration, discussion and cooperation. Having followed the journal entries of the students, we knew that all students who took part in this assessment had completed the journal to varying degrees of competency and therefore that all students would have some material with which to negotiate within the group.

Another challenge was the transparency of the assessment process. To this end we had to overcome general resistance to the process of peer review and group work generally, allay fears that the result might be in any way unfair, involve personal feelings or could not be effectively and objectively reviewed by the tutor.

We had previously noted from student feedback that both synchronous and asynchronous discussion had proven to be difficult when students were separated by time-zones within Australia (up to three hours from West to East in summer time) and

around the world with much larger time difference implications. Many students were in full or part time employment and many had family responsibilities that gave them a very limited window of opportunity to contact other students. To address these difficulties, we placed students in groups according to location time zones within Australia, and as far as practicable within reasonable zones throughout other countries. We found that this worked very well — only one student (located in Australia) complained that her family schedule interfered with her communication with other students. Enabling synchronous discussion through tutorial time-zone placement meant that we could expect that group discussion and peer assessment become a realistic endeavour.

We investigated a range of Wikis to support this process. Wikis have a range of features that can allow users to add content that can be edited by other users. They can allow the creation of documents without the need for technical skills around HTML. They can also show a history of a page's development that has been created, changed and mediated by the Wiki community (Guo & Stevens, 2011). We had previously experimented with a wiki application called EtherPad started by an innovative company in 2009. Within months, Google had acquired both the team and the application. After a vociferous worldwide protest, Google shelved its plans to kill off EtherPad and made it freely available and open source. A number of clones appeared. We chose a hosted site for the clone TypeWithMe (TWM), and introduced our students to the application. We asked them to form groups of five, with one member of the group having the responsibility of setting up a wiki and inviting other students in. We also asked them to invite tutors in, although we did not expect or want tutors to be part of the working wiki process.

TWM has a number of attractive features. It is elegantly designed, intuitive, agile and free and offers affordances which lend themselves to collaborative endeavour. Participants' written contributions are colour coded, there is a synchronous chat pad, a wiki page which is editable but undeletable and the site is private. Students within the same time zone were able to arrange to meet online, but also able to work asynchronously if and when they wished, leaving a message on the chat pad for other participants. There were a few hiccups. TWM went off-line twice for a couple of days which students found disconcerting, but because the site was hosted we were able to contact the CEO of the company and reassure the students that their work had not disappeared.

We felt that the assessment exercise, with its problem-based nature and freedom to choose a mode of presentation, would encourage students to discuss their learning and to cooperate in sharing technological knowledge, resulting in upper levels of cognitive development expressed in Bloom's taxonomy: analysis, synthesis and evaluation. We acknowledge that assessment is a form of power, but seek to subsume that power within actively designed processes that use constructivist principles. Further, studies have acknowledged that technology can support authentic assessment (Bennett, 2002 as cited in Buzzetto-More & Alade, 2006, p. 256).

Using Palloff and Pratt's (2009) rubric design approach we built a rubric created to test effective engagement within the group. Students were asked to assess engagement in five areas: Contribution, Quality of work, Preparedness, Working with others, and Time management within four degrees of competence: Routinely, Usually (or Almost Always), Sometimes, Rarely (as shown in Figure 1). The rubric was highly descriptive at each level, using verbs like participate, provide, contribute, procrastinate, ensure, listen, support, engage and share. We asked students to submit this as a private document through the Blackboard Assignment Manager and gave them one week after the submission of the assignment so that they would have some time to carefully consider the rubric. Half the marks for the assignment came from peer assessment of the effectiveness of individual contribution to the group effort and half the marks were assigned by the tutor for the finished product. This equal weighting was intended to show students that we take group work seriously and that we value their knowledge and opinion of group dynamics as an important contributory factor in the completed work.

PEER ASSESSMENT EDP155				
Please note that you need to look carefully at this rubric <u>before</u> you start your group work. At the end of week eight, you will complete this rubric for yourself, before completing the peer assessment document for your group. (This will be supplied at the end of week 8 and must be placed in the Drop Box as directed by the end of week 9)				
CATEGORY	4	3	2	1
Contributions 4	Always provides useful ideas and material when participating in the group discussion. Takes on an organizational role in the group and puts in considerable effort.	Generally provides useful ideas and material when participating in the group discussion. Is a reliable and competent group member.	Occasionally provides useful ideas and material when participating in the group discussion. A satisfactory group member who is obliging and does what is asked. Not always self-directed.	Very rarely provides useful ideas when participating in the group discussion. May refuse to participate or actively obstruct progress with argument or obstruction.
Quality of Work 4	Work is of consistently excellent quality.	Work is of high quality.	Work occasionally needs to be edited by other group members to ensure quality.	Provides work that is not up to standard and cannot be used without considerable revision by others
Preparedness 4	Work is always ready. Is pro-active in looking for material	Almost always looks out needed materials and is ready to work.	Sometimes provides materials but is difficult to keep on focus.	Has to be constantly be reminded and chivvied to supply work.
Working with Others 4	Actively listens, shares and supports efforts of group members and attempts to keep the group working harmoniously. Self- directed and positive about the task. Is reliable about meeting on-	Generally listens shares and supports group members. Is a team player and rarely misses an agreed on-line meeting.	Usually listens, shares, and supports the group. Sometimes causes problems, but is generally able to accommodate group decisions. Might miss the	Finds it very challenging to work with a group: behaviour can be difficult. Rarely if ever engages in synchronous

	line and contributes well to the wiki discussion.		occasional synchronous discussion, but usually “catches up” on the wiki later.	discussion: is not present on the wiki. Is content to let others do the work and “go along for the ride”
Time-management 4	Is always mindful of time constraints, and tries to keep the group organised and working to a schedule. Can be relied upon to keep to deadlines.	Almost always is aware of group agreed deadlines and can usually be relied upon to produce material on time.	Sometimes procrastinates, but comes up with material on or just after the deadline. Can cause anxiety in group members by not always being reliable about agreed timelines.	Cannot be relied upon to produce material on time. Has many excuses and group deadlines have to be extended because of poor time management.

Figure 1: Rubric for Assessment task.

It is recognised that some students dislike group work and indeed, some feedback on the unit indicated that for some students this was indeed the case. Student responses indicated that this was mainly linked to unwillingness to engage with others, a perception that less able students would benefit undeservedly and that perceived personality clashes might affect marks. However, staff reassured students by explaining that the non-deletable Time-Slider function within the application could be useful if tutors felt that students’ assertions of non-performance by an individual needed to be verified. In these few cases, students were directly contacted by the tutor and asked to give some reasons why they should share in the mark assigned to the finished assignment by the tutor. Students in this position were uniformly unable to do so as the real time chat pad and the undeletable evidence on the wiki page demonstrated their lack of engagement.

Findings

In a post-unit survey, students were asked to comment on the wiki experience (see Table 1), There were 247 responses out of a completing cohort of 1147 students and, even though most of the respondents had not used a wiki before, the overwhelming majority reported they found the wiki easy to use and could use it sufficiently to teach another how to use it.

Table 1: Student Responses to Questions Regarding the Use of Wikis and TypeWithMe

Question	Yes		No	
	Respondents	Percentage	Respondents	Percentage
Is this the first time you have used a wiki?	192	79%	51	21%
Did you find TypeWithMe easy to use?	202	87%	31	13%
Do you feel that you have learned enough about wikis to show someone else how to use this technology?	159	92%	14	8%

These results were enough to confirm that the careful introduction of this technology was a strategy which enabled students to engage positively in group collaboration. An additional survey administered by OUA served to further confirm this view. There were 255 respondents to this survey scored on a Likert scale of 1 - 4 with no neutral option. Mean scores revealed an overall satisfaction rating for the unit of 3.30 significantly higher than provider and OUA mean scores.

Several students' responses on the use of the wiki reflected the ease of communicating, for example, "enabled working in groups to be so much easier," "helpful when we needed to talk," "a good way to communicate when not everyone can be online at the same time," and, "record of our conversations, ideas, etc., that others could use to catch up on if they missed a 'meet up.'" The wiki also had an impact on the community cohesiveness: "I found the use of wiki with the group assignment very helpful and through this I have found a bond amongst some of my fellow peers making life studying on line a lot more relaxing," "great tool for meeting up with people," and, "a collective for ideas." Most negative comments focused on non-participation or poor connections, rather than the use of the wiki.

Students' feedback addressed the positives of working in a group, for example, "group work allowed for usually isolated study work to become less lonely," "the assessment had me constantly assessing my own learning," "group work kept us active," and, "group work helped us to connect." The use of the wiki impacted on the group work, "TWM was really user friendly and an efficient way to work as a group," "TWM was really easy and a great way to communicate," "the use of wiki pages helped in building knowledge understanding and creating a community of learners," "the group assignment, where we were able to pick the mode of presentation and topics we wanted to discuss," "the use of new technologies to engage and motivate," and, "learning how to learn in a more efficient manner."

The peer assessment exercise returned valuable information about group dynamics which was made transparent by the group wiki. It was made clear to students that if they failed to engage with the exercise that they would not automatically be assessed merely because their name was in the group list. In cases where there was discordance within groups, the tutor or unit coordinator used the time slider to determine the level of contribution and this was used in allocating marks. Of the 147 written responses to the question regarding experiences using peer assessment for the assignment, 98 were positive and 33 were negative (with 16 either neutral or not addressing the topic). As mentioned previously, specific comments addressed issues regarding the group dynamics (enabling the tutor to "get a real inside look at how the group worked together" and enabling students to "reflect on other peoples (sic) efforts"), as well as the opportunity to provide feedback to colleagues ("helps with the whole experience of giving constructive feedback," "I appreciate the experience of evaluating my peers as I see it as good practice") and the impact on their own learning (such as application of the criteria giving greater

consideration of the criteria – “it actually put into question what standards were to be achieved;” and how to work in a group – “it helps to improve performance for the next group assignment”).

Conclusion

Even though a large proportion of students had not used a wiki an overwhelming majority found TypeWithMe easy to use and felt confident enough in their ability to teach someone else how to use it. Student responses to the unit satisfaction surveys showed that group work was seen in a positive light, with comments often linking the technology used (TypeWithMe) to the positive aspects of group work. This demonstrates the impact of the technology on the collaborative aspect of the assessment and reiterates the importance of matching the technology to the task. Further research to investigate which aspects of the wiki had most impact would be beneficial as it would assist in making strong links between pedagogy and the features offered by technology.

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[eScholar 2010 – Lynne Quartermaine – Case Study Video](http://youtu.be/yB9046VcAtQ)

<http://youtu.be/yB9046VcAtQ>

Web-based active learning and frequent feedback: Engaging first-year university students

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KEYWORDS

Active learning, online quizzes, effective questioning, student engagement

Abstract Web-based technology is particularly well-suited to promoting active student involvement in the processes of learning. All students enrolled in a first-year educational psychology unit were required to complete ten weekly online quizzes, ten weekly student-generated questions and ten weekly student answers to those questions. Results of an online survey of participating students strongly support the viability and perceived benefits of such an instructional approach. Although students reported that the 30 assessments were useful and reasonable, the most common theme to emerge from the professional reflections of participating lecturers was that the marking of questions and answers was unmanageable.

Background

In 2009, 30% of first-year university students in Australia and New Zealand reported that they had considered leaving university prior to graduation (Australian Council for Educational Research, 2010). Among 32 Australian universities surveyed, actual attrition rates ranged from 5.3% to 30.3%, with first-year attrition rates consistently the highest with respect to undergraduate students (Olson, 2008). The Organisation for Economic Cooperation and Development (OECD, 2007) defines survival rates for university undergraduate students as the proportion of those who enter a program who go on to graduate from that program. Against an OECD average of 71%, the survival rate for Australian undergraduate university students was 67.3%. The lowest undergraduate survival rates were reported for the USA (53.7%) while the highest were reported for Japan (91.5%). Fisher, Cavanagh and Bowles (2011) concluded that “completion of the first year is ‘more than half the battle’ in progression to degree completion” (p. 226). Not surprisingly, given the importance of an educated and skilled population for economic and social prosperity, Australia, as well as most industrialised nations (Andrews & Drake, 2011; Thomas, 2011), are increasingly focused on improving undergraduate university student retention and graduate rates (Coates & Ransome, 2011; Noonan, 2010). Based on a comprehensive review of the literature, Ferguson (2011) concluded that “student engagement [is] at the heart of student retention and success” (p. 107).

Undergraduate student engagement: active learning and frequent feedback

Student engagement refers to psychological investment in learning (Carini, Kuh, & Klein, 2006). Students are engaged when they are actively involved in their university studies, persist despite challenges and failure, and take pride in their academic achievements (Pike & Kuh, 2005). The National Survey of Student Engagement, pioneered in the USA and adopted in Canada, modified for use in Australia, New Zealand and South Africa, and currently being piloted in China, rests upon a body of research unequivocally establishing the relationship between university student investment of time, effort and interest in a range of educational activities and favourable academic outcomes such as increased performance, persistence and satisfaction (Trowler & Trowler, 2010). Specific aspects of undergraduate student engagement, such as involvement in learning processes, amount of time spent on academic tasks and quality of effort, have repeatedly been linked to positive university outcomes (Hu, 2011; Kuh, Kinzie, Schuh, & Whitt, 2005; LaNasa, Cabrera, & Trangsrud, 2009; Pike, 2006). Perlman, McCann and Prust (2007) surveyed undergraduate students with respect to their perception of behaviours most beneficial to successful completion of the course. From a list of 59 student behaviours, attending class regularly, completing required assignments on time and paying attention during lectures were identified by students as most critical to successful course completion. Braxton, Jones, Hirschy and Hartley (2008) concluded “that faculty use of active learning practices plays a significant role in the retention of first-year college students” (p. 71). “Engendering a climate where students can actively participate in learning may ease the issues involved in transition to university” (Fisher et al., 2011, p. 225).

In their seminal work, Chickering and Gamson (1987) summarised the research evidence into the seven most effective practices in undergraduate education which included active student learning and frequent student feedback. *Active learning* is a general term used to refer to any instructional method that requires students do something in the classroom rather than simply listen to a lecture (Auster & Wylie, 2006). Allen and Tanner (2005) defined active learning as “seeking new information, organizing it in a way that is meaningful, and having the chance to explain it to others” (p. 262). Such an orientation to instruction “emphasizes interactions with peers and instructors and involves a cycle of activity and feedback where students are given consistent opportunities to apply their learning in the classroom” (Armbruster, Patel, Johnson, & Weiss, 2009. p. 203). In contrast to traditional lecture format, research has repeatedly established the benefits of undergraduate education that actively involves students in the processes of learning including improved student attitude (Prince, 2004) and increased academic achievement (Knight & Wood, 2005; Freeman et al., 2007). Cavendish (2010) reported that students rarely complete assigned readings prior to attending traditional lectures. Chevins (2005) observed that undergraduate students “were actively engaging with the text during preparation of the in-course assignment, but not with the lectures” (p. 2). Moses and Litzkow (2005) substituted a brief quiz followed by active-learning problem-solving activities in place of lectures in a nuclear reactor theory course. At the end of the

semester, students were surveyed. “Seventy-five per cent reported that the course required more self-discipline than most other courses, and 56% reported that it required more time than most other courses” (p. 29).

Lo and Prohaska (2011) reported on the redesign of an introductory sociology course in order to improve student success by adding active and collaborative learning activities that gave students greater responsibility for learning. The new hybrid course provided most learning materials online, required electronic submission of assignments and tests and reported assessment results and other feedback promptly. In its biggest break with tradition, the course’s contact hours were one-third of those mandated under the old syllabus. Resulting improvements included improved student final grades and increased numbers of students enrolled in the course. Esposto and Weaver (2011) described a case study of a strategy of continuous cooperative student assessment which was introduced into scheduled tutorial classes in an attempt to improve flagging attendance and low student motivation. The assessment tasks were designed to be undertaken in teams of two students, with ongoing feedback as an integral component. After a single semester of implementation, attendance at tutorials nearly doubled relative to previous years. Average assessment marks rose a full grade compared to the previous student cohort. Similarly, across two sections of an introductory business course, Michel, James and Varela (2009) compared the impact of an active teaching approach and a traditional or passive teaching style and concluded that “if students in a particular course are ‘forced’ to engage through active learning methods because their grades depend on how well they engage, student learning can improve with regard to their class material” (p. 64).

One approach to active student involvement in the learning processes is student-generated questions and answers (Yu, Liu, & Chan, 2005). “In traditional classrooms, teachers are frequently viewed as the main source and transmitters of knowledge, whereas students are expected to take on the role of receivers and recorders” (Yu, 2011, p. 484). From such an instructional perspective, student learning is assessed with teacher-generated questions. In comparing the effectiveness of teacher-generated versus student-generated questions, Bulgren, Marquis, Lenz, Deshler and Schmaker (2011) reported that, overall, differences representing large to very large effect sizes were found between the test scores of students in the two groups. “Specifically, students taught using the question-exploration routine earned higher total test scores than did students taught using the lecture-discussion method” (p. 578). Reported benefits associated with student-generated questions included increased levels of student reading comprehension, retention of information, use of cognitive strategies, motivation, satisfaction, communication, interaction and problem-solving (Abramovich & Cho, 2006; Barlow & Cates, 2006; Brown & Walter, 2005; Yu & Liu, 2005, 2009). Written response to student-generated questions has been associated with enhanced student achievement (Papadopoulos, Demetriadis, Stamelos, & Tsoukalas, 2010). Menary (2007) concluded that “creating and manipulating written sentences are not merely outputs from neural processes but, just as crucially, they shape the cycle of processing that constitutes a

mental act” (p. 622). The actual process of writing can be used effectively as a tool for supporting students in developing critical thinking and increasing their analysis, inference and evaluation skills (Quitadamo & Kurtz 2007). The benefits of reciprocal peer questioning and responding, a form of active student learning, are clearly established (Johnson, 2006a; King, 2002).

Related to active student involvement in the learning process, frequent feedback on the quality of student learning is an essential practice in effective undergraduate education (Chickering & Gamson, 1987). Feedback is “usually understood within education as information about how successfully a task has been or is being fulfilled” but can also be defined as “any information, process or activity which affords or accelerates learning, whether by enabling students to achieve higher-quality learning outcomes than they might have otherwise attained, or by enabling them to attain these outcomes sooner or more rapidly” (Tang & Harrison, 2011, p. 583). From such an orientation, the concept of feedback is expanded to refer to not only knowledge of assessment results, but also to assessment processes or activities. Glover (2004) concluded that “assessment has an overwhelming influence on what, how, and how much students study” and that “one of the most powerful influences on student achievement is feedback” (p. 6). “There is more leverage to improve teaching through changing aspects of assessment than there is in changing anything else” (Gibbs & Simpson, 2003, p. 22). The critical role of assessment in education has been underscored by advances in cognitive science that have contributed to increased understanding of the mechanisms by which learning is maximized; a variety of assessment strategies with prompt feedback to students is recommended (Goubeaud, 2009). Clarke, Heaney and Gatfield (2005) discussed the personal demands faced by contemporary university students, most of whom combine their studies with employment and sometimes with childcare responsibilities. In view of such commitments, many university students “seek those assessments that involve minimal group project work, are relevant, low risk and need relatively limited test revision time” (p. 51). Chevins (2005) described a study of the effects of partial replacement of lectures with a system of prescribed reading supported by weekly objective testing in a second-year animal physiology module. “Over a three year period, students’ reported study hours during the module increased significantly over their normal study time” (p. 1). However, since frequent quizzes are not necessarily compatible with all learning styles, Klappa (2010) suggested that university students be provided with a combination of activities to promote their active engagement in the processes of learning.

Active learning and frequent feedback with web-based technologies

Web-based technology is particularly well-suited to promoting active student involvement in the processes of learning (Deed & Edwards, 2011; Rhine & Baily, 2011). According to Yu (2011), the many advantages of network technology (e.g., time, place, device and platform-independence, immense storage space, high processing speeds, multimedia capabilities and instant data retrieval and management) facilitate the design and development of web-based student question-generation learning systems such as QAIS

(Barak & Rafaeli, 2004), Multiple Choice Item Development Assignment (Fellenz, 2004), ExamNet (Wilson, 2004) and Concerto II (Hirai & Hazeyama, 2007). Evaluation of the Question-Posing and Peer Assessment Learning System suggested that students' sources of motivation come from a hybrid of achievement, altruism, play and entertainment, security, challenge, satisfaction and confidence (Yu et al., 2005). In a web-based learning environment, the active process of writing questions and answers increased student domain knowledge and knowledge transfer (Papadopoulos et al., 2011). Johnson (2006a) reported a study in which first-year university students used WebCT Discussions to satisfy one of two study group conditions, reciprocal peer questioning or mnemonic devices. Students made postings according to their assigned study strategy in order to facilitate the learning of their group. While there were no differences between students in the two study conditions in terms of academic achievement, "students in the reciprocal peer questioning group reported higher levels of satisfaction with the virtual study experience" (p. 83).

In addition to promoting active student learning via question and answer instructional strategies, web-based technology facilitates frequent student feedback in the form of automatically-marked tests and quizzes. Grabe and Sigler (2002) provided university students with four web-based study tools: multiple choice practice test items, short answer practice test items, lecture notes, and textbook notes. Students who made use of the tools academically outperformed those who did not. Fritz (2003) reported a study in which university students in Spanish and French classes completed weekly web-based quizzes using Blackboard. Results indicated that online quizzes were viable in foreign language classes and that 10-15 minutes of class time each week became available for instruction rather than quizzes. "Instructor time was also greatly conserved since quizzes were self-correcting and self-tabulating" (p. 1). Itoh and Hannon (2002) concluded that "because of the convenience of online delivery, quizzes are well suited to the needs of today's liberal arts students who often participate in many extracurricular activities" (p. 551). Derouza and Fleming (2003) compared undergraduates who completed quizzes online with students who took traditional paper-and-pencil quizzes. Comparison of in-class examination marks revealed that students who took the quizzes online significantly outperformed student who took pencil-and-paper quizzes. Escudier, Newton, Cox, Reynolds and Odell (2011) "compared higher education dental undergraduate student performance in online assessments with performance in traditional paper-based tests and investigated students' perceptions of the fairness and acceptability of online tests, and showed performance to be comparable" (p. 440). Yate and Beaudrie (2009) concluded "that evaluating students through the exclusive use of online assessment is a reasonable approach that results in grades that do not differ from measuring student progress with exams that are given under proctored conditions (p. 69). Johnson (2006b) reported that first-year university student use of web-based quizzes was associated with increased academic achievement and that "short-answer and true-false online quiz items were differentially associated with measures of academic achievement suggesting that cognitive processing differed across item format" (p. 105).

Research Questions

Web-based technologies are amenable to active student engagement in the processes of learning including frequent student-generated questions and answers based on required readings and learning activities and frequent testing of student mastery of learning objectives. Are 30 web-based assessments during a 13 week study period viable for students and lecturers? How do students and lecturers evaluate their experience of frequent web-based assessments including student-generated questions and answers and automated online quizzes? Are there differences in evaluation of such frequent web-based assessments between male and female students, older and younger students and students in fully-online and blended learning classes?

Approach

All students enrolled in a first-year educational psychology unit were required to complete thirty web-based assessments during 13 weeks of study. The content of the unit included theory and research in child and adolescent development applied to professional practice in primary and secondary schools. Some students received instruction entirely online ($n = 23$) but most were in blended learning classes ($n = 154$) which included a three hour face-to-face seminar coupled with extensive online learning events. The blended learning classes included a maximum of 25 students. The fully-online learners had weekly *Illuminate Live* sessions during which material presented and discussed corresponded to that covered in the face-to-face seminars in the blended classes. Both fully-online and blended-learning students used Blackboard, the course management system used at their university. There were no assessments during the first two weeks and last week of the semester. Thus, the thirty assessments were distributed across ten weeks of instruction, specifically, three assessments each week.

The thirty assessment points included ten weekly online quizzes, ten weekly student-generated questions and ten weekly student answers to those questions. Specifically, each week students were required to complete a Blackboard multiple-choice test that assessed content covered during the previous week of instruction. Only one attempt was permitted for each quiz. Each quiz was available for one week following the weekly seminar or *Illuminate Live* session. Such limits forced students to consistently engage with required learning material. As specified on the unit outline for the blended classes, “it is critical that students independently read and study the required textbook chapters. The learning events that occur during the seminars are built upon the assumption that students have engaged with required learning resources as specified in the Unit Study Calendar. Quiz questions assess understanding, NOT recall of specific fact and, in this regard, it is unlikely that correct responses can be located in the textbook or lecture notes within the 20 minute time limit.” A similar statement appeared on the unit outline for the fully online learners with the focus on the *Illuminate Live* sessions rather than the face-to-face classes. Each quiz contributed 4% to the final unit grade for a total contribution of

40% for ten quizzes. Figure 1 provides the online quiz information and sample items provided to students in a Blackboard link.

During each of ten instructional weeks, as specified in the Unit Study Calendar, you are required to complete a timed (20 minutes) online quiz (i.e., 20 multiple-choice items). Quizzes are marked automatically and marks are entered in the Blackboard My Grades tool. Quiz questions assess understanding, NOT recall of specific fact and, in this regard, it is unlikely that correct responses can be located in the textbook or posted answers to questions within the 20 minute time limit. Quizzes are accessible for only one week, as specified in the Unit Study Calendar. Below are sample items taken from our Textbook Chapter 1. There is also a Practice Quiz (follow the link Online Quizzes) that you can take to build your confidence with the Blackboard Test tool.

Many well-known developmental theorists have focused on all children's progression through common stages. In other words, these theorists have emphasized:

- a. quantitative change and universality in development.
- b. quantitative change and diversity in development.
- c. qualitative change and universality in development.
- d. qualitative change and diversity in development.

Which of the following children is undergoing the best example of a non-developmental change?

- a. Thirteen-year-old Sally is undergoing a growth spurt.
- b. Six-year-old Ben clearly understands the difference between right and wrong after months of confusion.
- c. Nine-year-old Amy falls and breaks her arm.
- d. Five-year-old Tommy begins to role-play after months of talking only about himself.

Which one of the following examples illustrates the issue of nature versus nurture in development?

- a. Dr. Hepburn thinks that the course of children's development is largely predetermined at birth, whereas Dr. Tracy thinks that how children develop is influenced by children's home lives and educational experiences.
- b. Dr. Base thinks that children develop in a steady and continuous fashion, whereas Dr. Fitzgerald believes that children mostly develop in stages, in which development is rapid at times and slow at times.
- c. Dr. Bogart believes that 8-year-olds think in very different ways than 14-year-olds do, whereas Dr. Ball believes that the two age groups are quite similar.

Dr. Berg believes that some developmental changes occur in almost every child, whereas Dr. Wood believes that developmental changes are highly unique from one individual to the next.

Figure 1: Web-Based Quiz Information for Students

The thirty assessment points also included ten weekly student-generated questions and ten student answers to those questions. The questions and answers corresponded to the weekly material associated with each class (i.e., face-to-face seminars or *Illuminate Live* sessions). Blackboard Discussion groups were specific to each class of learners and, thus, no group included more than 25 students. As specified on the unit outline for the blended classes [or fully online learners], “prior to each of ten classes [or *Illuminate Live* sessions], having engaged with learning resources as specified in the Unit Study Calendar, each student will post a study question in Blackboard Discussions that will subsequently be answered by fellow students. Questions are evaluated by the lecturer for relevance to required learning content, clarity of expression and precision in thinking. Marks, ranging 0% to 2.0%, will be entered in Blackboard.” The ten posted questions contributed 20% to the final unit grade. The unit outline continued: “Within 48 hours following each class [or *Illuminate Live* session], each student is required to respond to one previously posted question. Responses are limited to a maximum of 1000 characters (approximately one

paragraph) and, in this regard, must be extremely concise. The lecturer will evaluate the response on the basis of demonstration of understanding, clarity of expression, precision in thinking and interpretation of required learning resources.” The ten posted answers contributed 40% to the final unit grade. Figures 2 and 3 provide marking criteria for student-generated questions and answers available in Blackboard and discussed with students in class or during the *Illuminate Live* sessions.

Score	Criterion	Sample
0.5	Question requires only recall of a specific fact.	What is meant by cognitive development?
1.0	Question requires demonstration of understanding beyond simple recall of facts.	Increased ability to remember instructions suggests which developmental domain?
1.5	Question requires synthesis of information.	How are cognitive developmental and social development related?
2.0	Question requires evaluation, the highest level of understanding.	Which theory of development is most useful for teachers?

Figure 2: Marking Criteria for Web-Based Student-Generated Questions

Score	Criterion	Sample
1	The answer is far too brief (30 words) and is poorly constructed in terms of vocabulary and sentence structure.	Cognitive development means changes in thinking and includes changes in the ability to learn remember, speak attention and solve problems. As children get older they get better at these things.
2	Although demonstration of understanding is apparent, the answer is too brief (76 words) and is poorly constructed in terms of vocabulary and sentence structure.	Cognitive development refers to changes in thinking processes and includes changes in the ability to learn, remember, speak, focus attention and solve problems. As children mature, changes in their brains make it easier for them to learn, remember, speak, focus attention and solve problems. But cognitive development is also influenced by experiences from the environment like parents talking to their kid and giving him lots of toys to play with. That would stimulate his cognitive development.
3	This answer clearly demonstrates understanding including synthesis of information and appropriate reference to our textbook. However, the answer is only 150 words in length and does not make reference to any sources outside of our textbook such as activities completed during our weekly workshops.	Cognitive development refers to changes in thinking processes and includes changes in the ability to learn, remember, speak, focus attention and solve problems. As children mature, changes in their central nervous system make it easier for them to learn, remember, speak, focus attention and solve problems. But cognitive development is also influenced by sensory stimulation. For example, in homes with many stimulating toys and activities, children’s cognitive development may be greater than that of children in unstimulating environments (textbook, p. 6), although this may be most apparent in extremely situation (textbook, p. 7). The most important cognitive developmental to ever live was Piaget (textbook pp. 13-14). Cognitive development influences and is influenced by all developmental domains like physical development and social-emotional development. Later in the term, we will examine both cognitive-developmental theories (textbook chapter 6) and cognitive processing theories (textbook chapter 70, both of which are important to understand cognitive develop

4	This answer is an excellent demonstration of understanding including synthesis of information and appropriate reference to our textbook, our workshop, and material outside required unit resources. The answer is the maximum length of 1000 characters.	Cognitive development refers to changes in thinking processes and includes changes in the ability to learn, remember, speak, focus attention and solve problems (Seminar 1). Central nervous system changes, due to maturation and environmental stimulation, make it easier for children and adolescents to learn, remember, use language, focus attention, thinking logically, engage in abstract thinking and logical reasoning and solve problems. For example, in homes with many stimulating toys and activities, children's cognitive development may be greater than that of children in unstimulating environments (textbook, p. 6), although this may be most apparent in extremely situation (textbook, p. 7) such as institutional children who fail to develop. For a tragic account of the effect of institutionalization on children's cognitive development, view this video clip on the Romanian orphans < http://www.youtube.com/watch?v=bvL_DGjGuhA >. Later in the term, we examine both cognitive-developmental theories (textbook chapter 6) and cognitive processing theories (textbook chapter 7), both of which are important to understand the biological and environmental focuses that give rise to cognitive develop.
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Figure 3: Marking Criteria for Web-Based Student-Generated Answers

Following marking of all assessments and posting of the final grades in Blackboard, all students who remained enrolled in the educational psychology unit ($n = 143$) were invited, via email, to complete a questionnaire using Qualtrics an anonymous online survey application. In addition to demographics such as student age and gender, eight survey items queried student satisfaction with the 30 web-based assessments. Students expressed their satisfaction by rating eight survey items on a 5-point scale ranging from, in the case of the first item, *very negative* (rating of 1) to *very positive* (rating of 5) and, in the case of the remaining seven items, *strongly agree* (rating of 1) to *strongly disagree* (rating of 5):

1. Describe your overall experience using technology in this unit.
2. I am disappointed with my learning experiences in this unit.
3. I found the workload in this unit to be excessive.
4. The requirements in this unit made me more anxious then in my other university units.
5. I would recommend this unit to other students.
6. The weekly online quizzes were useful.
7. Posting a question every week helped me learn the material.
8. Posting an answer every week helped me learn the material.

Fifty-eight students responded to the survey. Of these respondents, 48.3% were aged 18-19 years, 46.6% were 20-39 years of age and 5.2% were aged 40-59 years. Three respondents indicated part-time enrolment status while the remainder indicated full-time enrolment status. Almost 80% of respondents were female which is consistent with gender distribution trends in the participating university program. Forty-four (75.9%) of

responding students indicated that they were in blended learning classes; 14 (24.1%) indicated that they were in the fully-online class.

Two lecturers taught the first-year educational psychology unit which included managing the Blackboard site and marking the 30 web-based student assessments. One lecturer assumed most of the responsibility for Blackboard operations (for example, forming discussion groups for students to post questions and answers and releasing quizzes each week) while the other lecturer assumed more responsibility for marking student questions and answers. Each lecturer engaged in professional reflective journaling with respect to their experiences with students, the technology and the marking of assessments. The lecturers frequently discussed instructional issues among themselves and such conversations were often noted in their professional journals. During the 13 week semester and until all final marks were submitted, one lecturer made ten journal entries while the other made 17 entries. Entries varied from several words (for example, *marking is unmanageable and unsustainable*) to several sentences which included details of conversations with students and with the other lecturer. Professional reflective journal entries were organized and analysed in terms of themes. Some journal entries included multiple statements and sentiments and, thus, multiple themes.

Findings

Student evaluations of the unit, generally, and the application of instructional technology, particularly, were extremely positive. On a 5-point scale, where a rating of five was associated with the words *very positive*, the survey item *Describe your overall experience using technology in this unit*, on average, was rated by participating students as 4.31 (standard deviation 0.71). As illustrated in Figure 4, no students rated the use of technology as *very negative* and almost 90% rated the use of technology a *positive* or *very positive*. Analysis of variance revealed no significant differences in overall satisfaction with the instructional applications of technology for male and female students, older and younger students and students in fully-online and blended learning classes.

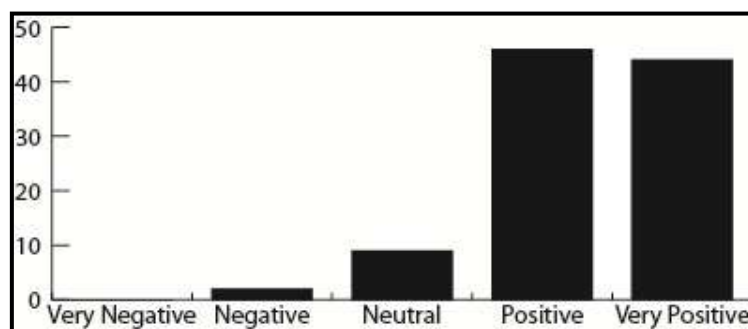


Figure 4: Percentage of Students Selecting Each Response-Option for the Survey Item *Describe your overall experience using technology in this unit*

More specifically, students expressed collective agreement that the weekly online quizzes were useful and that posting weekly questions and answers facilitated mastery of required learning content. As illustrated in Figure 5, on a scale ranging from *strongly agree* to *strongly*

disagree, on average, participating students rated the utility of the weekly quizzes as 2.28, posting weekly questions as 2.07 and posting weekly answers to those questions as 1.90. Thus, in general, students expressed the perception that the weekly web-based assessments were useful and helpful. Correspondingly and as presented in Figure 6, students were satisfied with their learning, found the workload manageable, were comfortable with the assessment and would recommend the unit to other students. Analysis of variance revealed no significant differences in satisfaction ratings for male and female students, older and younger students and students in fully-online and blended learning classes.

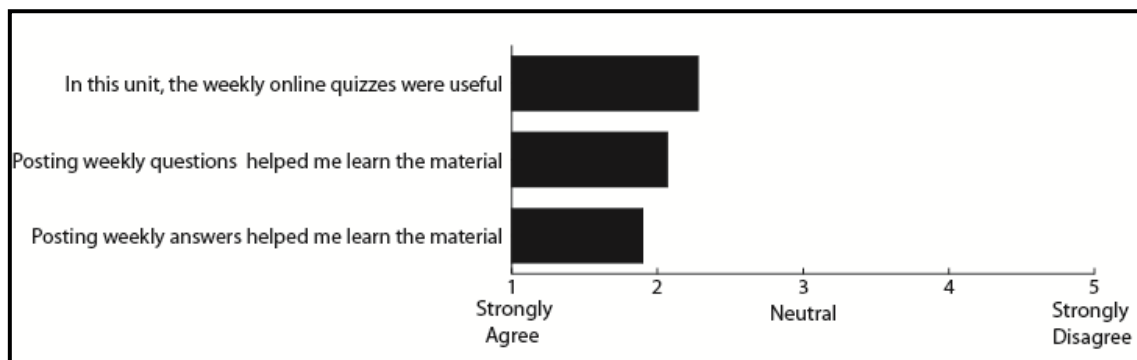


Figure 5: Average Student Ratings of Survey Items that Queried Satisfaction with Web-Based Assessments

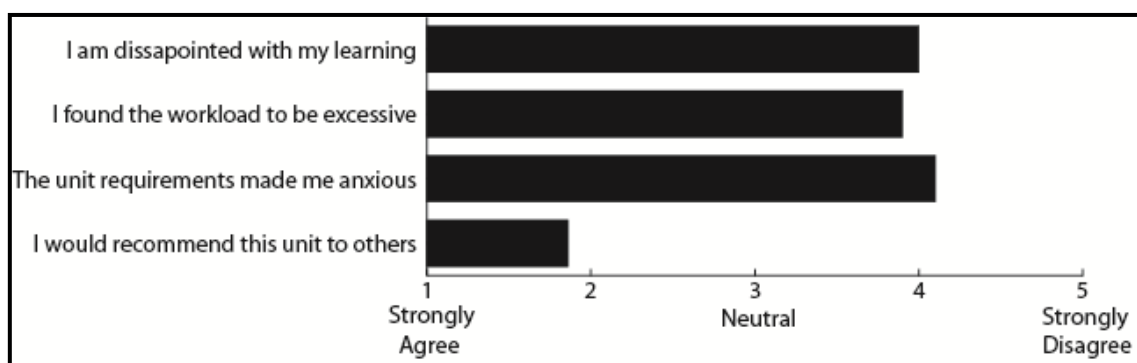


Figure 6: Average Student Ratings of Survey Items that Queried Satisfaction with Learning Events

Figure 7 provides graphic representation of the number and nature of the professional journal entries made by the two lecturers involved in the applied investigation. The most common comments reflected concern with marking and grading, specifically, the challenges of marking students' questions and answers each week, providing detailed feedback and maintaining consistency across lecturers, students and weeks. For example, one lecturer wrote, "I remember this. Like when I almost drown as a child. Every time I tried to come up for air, another wave smashed my head back down under the water." Another professional reflection included, "Not easy. So many marks allow students to compare their marks with each other and for different posts. They question why one answer scored 3 out of 4 and another, seemingly identical, scored 2.5/4. Yikes." Many lecturer reflections were extremely positive, particular with respect to student engagement. For example, "Attendance is excellent. The students are eager to cite their

lecture notes in their posts in order to score full marks.” Correspondingly, “The weekly quizzes force the students to engage regularly rather than cramming before exams.” Additionally, “Shocking! Many students have mentioned that they are reading the prescribed textbook chapters prior to class.” Nine professional journal entries reflected technical problems managing the weekly online quizzes. Most commonly, students lost internet connectivity which resulted in no mark entered in *My Grades* but the student was unable to retake the quiz. One lecturer frequently complained about the need to reset student quizzes. Four journal entries focused on students concerns including reasons for not completing weekly assessment and specific questions regarding unit content and assessment format. For example, one lecturer wrote, “This semester, I am receiving far more email from students seeking clarification of concepts. I suppose this is good?”

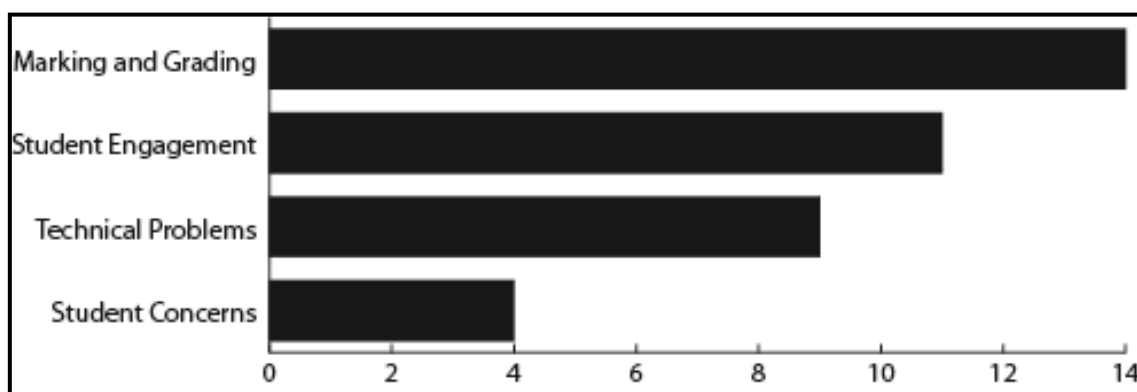


Figure 7: Number and Nature of Lecturer Reflective Professional Journal Entries

Conclusion

Results of the current applied investigation add to the growing body of research that confirms that web-based technologies facilitate active student engagement in the processes of learning including frequent student-generated questions and answers and frequent testing of student mastery of learning objectives. The 30 web-based assessments during a 13 week study period were appreciated by students but problematic for the lecturers. Overall, student evaluations of their technology-rich learning experiences were extremely well-received. Participating lecturers, however, while recognizing the clear benefits to students, expressed considerable concern regarding the demands of marking students' questions and answers each week. Indeed, although the weekly quizzes were marked automatically, many students required their quizzes to be reset due to reported loss of their internet connection during quiz completion or lack of understanding of online quiz requirements such as time limits and required completion once the quiz was started. Increased lecturer effort to ensure that students understand the online quiz conditions may reduce the need to reset quizzes. Additionally, it may be that student engagement in the processes of learning could be maintained with a rotating questions and answers. For example, during one week, half of the students might post questions while the other half of students answers those questions. The following week, student

roles might be reversed. In this way, lecturer marking would be significantly reduced while students remain engaged in weekly web-based postings.

Alternatively, peer assessment has been found to reduce teacher workload and improve the quality of student learning (Bouzidi & Jaillet, 2009; Yu, 2011). Peer assessment is reportedly as valid as the instructor's judgment (Cho, Schunn, & Wilson, 2006; Topping, 2008). Web-based learning environments facilitate peer assessment (Wen & Tsai, 2006) and the benefits of utilising online peer assessment have been established for both students and teachers (Hou, Chang, & Sung, 2007; Xiao & Lucking, 2008). Proper usage of online environments for peer assessment can supply a higher level of anonymity and provide more freedom of time and location for the students, thus stimulating feedback exchange among peers (Tsai & Liang, 2009). Teacher control is abandoned when students are entrusted to provide feedback to ensure work quality. The inclusion and use of peer assessment satisfies Web 2.0 technology principles such as *user as contributor*, *increased participation*, *decentralization* and *radical trust* (Abramovich & Brouwer, 2008). In the context of the current investigation, students may have provided feedback including grades for the posted questions and answers of their peers. Having liberated the lecturer from marking students' questions and answers, the test tool may have included written-response items in addition to multiple-choice items which could have been graded by lecturers thereby providing students with increased feedback on their demonstrations of learning and increased opportunities to write, an important feature of university studies.

Effective use of questioning is a fundamental feature of best practices in undergraduate education (Mastascusa, Snyder, & Hoyt, 2011). Although questions are used for many instructional reasons such as focusing attention, promoting recall, and encouraging reflection, using questions to stimulate critical, or higher-order thinking is one of the most important goals of education (Gibson 2009). Question types are dichotomised to include selected-response (e.g., multiple choice, true-false and matching items) and constructed-response (e.g., fill-in-the-blank, short answer and essay items). The current investigation included teacher-generated multiple-choice items in the ten weekly online quizzes and ten student-generated short answer questions. As suggested by previous research, different question types may contribute to different types of student learning (Fellenz, 2004; Johnson, 2006b; Wilson, 2004; Yu, 2011). As previously noted, reduced lecturer marking of student questions and answers may have facilitated use of the Blackboard Test Tool to deliver other types of questions including, most notably, constructed-response. Additionally, particularly given that participants were enrolled in a course of teacher preparation, students might have used a web-based question and answer (QA) system to post and answer a variety of questions included selected-response items. According to Zhang (2010), QA systems should be designed according to principles of human learning. Specifically, 1) different types of questions should be answered in different ways, 2) answers should not be given directly but instead learners should be encouraged to find the answers by themselves and 3) the function of the synchronous interaction should be added.

There were no significant differences between male and female students, older and younger students and students in fully-online and blended learning classes in evaluation of their web-based experiences and assessment in the introductory educational psychology unit. Since sample size was small, such lack of significance may be an outcome of the specific study. Nonetheless, while further investigation is required, it may be the case that first-year university students, irrespective of gender, age and learning environment, appreciate learning experiences that have many assessment points and make extensive use of web-based technologies. Indeed, recent research has established the erosion of gender-differences in attitudes and practices related to web-based technologies (Helsper, 2010; Horvat, Oreski, & Markic, 2011). Additionally, as the internet has been popular for more than 25 years, user age is increasingly unrelated to use of web-based technologies except in the case of elderly individuals (Australia Bureau of Statistics, 2008; Statistics Canada, 2011; U.S. Census Bureau, 2012). The current applied investigation was based on exemplary undergraduate instructional practice including active student involvement and frequent feedback on student mastery of required learning content (Chickering & Gamson, 1987; Mastascusa et al., 2011). It may be the case that sound instruction is equally appreciated across all learning conditions including fully-online and blended learning environments.

The technology solution utilised to implement the web-based learning activities may have implications for future application. Whilst an asynchronous discussion board provided a sound platform for the questions and answers, it proved to be challenging in terms of marking. Originally, the lecturers in this study trialled the “Hotseat” technology developed by Purdue University, however, due to a delay in rolling out the live environment, it was decided to retreat to Blackboard discussion boards as a solution. For future implementation, it could be beneficial to utilise a more fluent technology, such as Hotseat, that allows lecturers to move in and out of the questions and answers, and provide their feedback, in a more fluent manner.

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Twittering informal learning and student engagement in first-year units

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KEYWORDS

Twitter, social media,
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facilitation

Abstract This chapter outlines an investigation into the utility of the online service Twitter as a tool for facilitating informal learning amongst first-year university students. Twitter was introduced to two first-year student groups, both taking the unit Web Communications 101; one group in a campus-based blended learning mode, which utilized traditional face to face tutorials, while the second version was delivered fully online via Open Universities Australia. The ways in which students used Twitter was recorded and examined, highlighting three main uses: socialising, resource-sharing and posing questions. Students' perception of Twitter and its effectiveness as an informal learning tool was examined via a quantitative survey and a number of qualitative follow-up interviews. Notable differences emerged between the blended learning group and the fully online learners in terms of their attitude regarding Twitter use for facilitating informal learning. The chapter concludes with four recommendations regarding the implementation of Twitter as an informal learning tool for students.

Introduction

While universities now routinely offer and frame educational experiences via the internet, the implementation of online learning is often predicated on, and driven by, the choice of specific types of software, often referred to as Learning Management Systems (LMSs). While increasingly complex in the tools they offer, in general, LMSs attempt to digitally replicate the design and experience of a traditional classroom environment. At first glance, offering an approximation of the classroom would seem the logical approach as it brings familiar notions and expectations, reassuring institutions, educators and learners that whilst online they are still getting a 'real' university experience. Indeed, for online learning providers such as Open Universities Australia (OUA), the contributing educational institutions are contractually obligated to ensure that their online units match the on-campus equivalents as closely as possible. To facilitate online learning, lectures are now routinely captured as recorded audio and/or video streams; readings, unit notes, and other learning resources which are delivered via electronic repositories in university libraries; and synchronous tutorial discussions are replaced by asynchronous discussion

boards or sometimes synchronous interaction via chatrooms or other real-time discussion tools. However, while LMSs offer a recognisable simulation of many of the formal elements of university education, with its own challenges and differing levels of success (Lane, 2009; Leaver, 2003), the informal learning opportunities are less widely addressed.

While there is considerable debate about the exact definition of informal learning, for the purposes of this chapter, informal learning is used to mean those unplanned interactions, exchanges and connections which broadly contribute to meaningful learning without being explicitly driven by curriculum (Greenhow & Robelia, 2009). These might be conversations between learners in common spaces such as coffee shops, libraries, study groups or even just comments made on the way out of a tutorial room. Informal learning includes the development of social ties, bonds and a sense of community between learners, as well as more learning-centred activities such as mutual support in completing assignments, sharing experiences and resources, and dealing with educational policies and procedures. Informal learning is also part of the broader area of student engagement, which emphasises the social and cultural contexts that encourage learning beyond the classroom and curriculum. For on-campus students, a great deal of student engagement and informal learning occurs simply because learners are physically in the same room, without any explicit pedagogical driver. If informal learning opportunities within education are to be similarly available to online learners, then the shift away from shared physical spaces needs to be matched with an increase in potential online interactions which are somehow related to, or spring forth from, formal learning, but are not contained by formal moments or the tool of formal education, the LMS. Given that impetus, this chapter outlines an investigation into the utility of the online service Twitter as a tool for facilitating informal learning by examining its use by two first-year student groups, both taking the unit Web Communications 101; one group in a blended learning mode, which utilised traditional face to face tutorials, while the second version was delivered fully online via OUA.

What is Twitter?

Launched in 2006, and becoming increasingly popular since 2007, Twitter is an online platform which describes itself as “a real-time information network that connects you to the latest information about what you find interesting” (Twitter, 2011). Beyond the corporate speak, Twitter is generally regarded as either a micro-blogging tool or a scaled down social networking service. At a basic level, Twitter allows users to create short messages – called tweets – of up to 140 characters in length, shared publicly¹; with the most recent tweet displayed at the top of a user’s Twitter page, hence the micro-blogging description². Tweets may contain links, are usually shared publicly, may be directed to

¹ It is possible to create a ‘private’ Twitter account, only visible to specified Twitter users, but the general use of Twitter leans toward public accounts to be useful. There are no publicly available statistics on the number of private Twitter accounts, but the presumption is that it is a very small percentage of overall Twitter users.

² Blogs, like many other forms of social media, display the most recent posted entry at the top of the blog, with the content thus displayed in reverse chronological order.

another Twitter user (using the '@username' convention to specify a recipient), and may also be sent privately between individuals using a direct message function. Twitter meets the basic definition of a social networking site established by boyd and Ellison (2007) in that it is an online platform which allows users to "(1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system" (boyd & Ellison, 2007, p. 211). However, the ways individuals use their Twitter accounts tends to determine whether it is more social, more about sharing information, or more task specific. Given that Twitter as a company emphasises information sharing, this tends to be the way most users conceptualise their use of the tool. Whilst much smaller in terms of users than the social networking giant Facebook, as of July 2011 Twitter still had more than 200 million users, generating over 350 million individual tweets every day. Significantly, in 2010 the US Library of Congress announced that they had formed a partnership with Twitter and would archive all public tweets (Lohr, 2010). While a valuable resource, this partnership also explicitly indicates the presumption that most Twitter activity is public, in comparison with other social networking services which have a higher proportion of content shared with limited numbers of people using privacy controls.

Twitter in higher education

Twitter has been deployed in a number of ways in higher education, in most cases harnessing the service as a way to increase communication and connectivity between learners and educators. In a large-class undergraduate unit, for example, Twitter was explicitly introduced and students were formally required to use it weekly; assessing its use, it was found that Twitter "offered an important alternative avenue for the students to develop interpersonal connections and rapport with their classmates and the instructor" (Elavsky, Mislán, & S. Elavsky, 2011, p. 225). Similarly, Stieger and Burger (2010) found that Twitter was particularly useful in asking students to provide ongoing formative evaluation of a unit, leveraging the close to real-time feedback the platform can provide. Moving away from the campus, practicum students have used Twitter to successfully maintain contact with one another and with teachers (Wright, 2010). In a relatively small scale but important study, Junco, Heiberger, and Loken (2011) examined the impact of Twitter in 'educationally relevant' ways, including enhancing student engagement. Their study not only demonstrated increased contact and sense of connection between students and teachers due to Twitter use, but also, significantly, saw students increase their sense of connection and cooperation with one another.

While many educators are far from early adopters of technology, Twitter is becoming increasingly familiar in higher education. A US survey conducted in August 2010 of 1400 higher education professionals found that over 35% of the respondents use Twitter (a rise of 5% since 2009); of those using Twitter, less than 3% expected their Twitter use would decline; but, significantly, a number of respondents who used Twitter indicated that they saw little or no evidence that their students used Twitter at all (Faculty Focus,

2010). Kirsten Johnson (2011) discovered that for students who are on Twitter, when teachers tweet, those that share appropriately chosen social information are more likely to be seen as credible by students as opposed to teachers who only share resources. In terms of student engagement, this finding suggests that a sense of social connectivity, even on a relatively limited scale, makes teachers appear more credible. Unlike Facebook, for educators Twitter use is not just a question of shaping student use, but also, in many cases, getting students onto Twitter in the first place.

Deploying Twitter in Web Communications 101

Web Communications 101 (Web101) is a first-year unit run at Curtin University. It can be taken as part of the Bachelor of Arts (BA) degree, in the Internet Communications major, as part of the Mass Communications degree, or as an elective unit across a range of other majors and degrees. The unit runs both semesters, with a typical enrolment of about 175 in first semester and 60 in second semester. The vast majority of Curtin students take the unit in an internal mode (i.e., with face to face tutorials and lectures) but it is available externally. The unit has traditional lectures, which are also recorded and available as streaming or downloadable audio or video files, the unit content is provided online via the Blackboard LMS, and internal students attend weekly face to face tutorials, while external students have their discussions asynchronously using Blackboard's discussion board tool. The unit also runs in an entirely online mode through Open Universities Australia (OUA) which has no face to face component and students are spread across Australia and, indeed, a number of other countries. OUA runs four consecutive 13-week study periods each year, and Web101 is offered every study period, with enrolments typically ranging from 140 to 200 each study period. OUA students access their lectures and unit material online using Blackboard and their tutorial discussions are initiated on the Blackboard discussion boards.

The Internet Communications degree, of which Web Communications 101 is part, is driven by the idea of 'knowledge networking', which emphasises that learning and teaching increasingly happen in networked environments, often utilising networked approaches, but here networks do not refer to specific online tools but rather a broader sense of connectivity which is typified by, but not limited to, online communication. As Allen and Long (2009) argue: "Knowledge networking involves knowledge work that is shared, distributed and fragmented. Increasingly, students come to university education already involved in knowledge networking . . . though their conscious understanding of this kind of work can vary significantly from naïve to sophisticated." Despite the still popular but highly overblown myth of the digital native (Bennett, Maton, & Kervin, 2008), the unit introduces students to knowledge networking and frames online communication in terms of the concepts of collaboration and identity, but has to be broad enough to allow for the full spectrum of student familiarity, ranging from online aficionados through to students for whom anything beyond basic email is alien. Thus part of the weekly learning in Web101 includes the introduction of various online tools,

ranging from blogs, to social bookmarking, to content sharing and manipulation, through to the use of Twitter.

Web101 is taught in three modules: the first examining the early history of the internet and the emergence of the World Wide Web; the second exploring the shift to what is broadly called Web 2.0 or the shift to participatory culture; and finally a third module exploring issues of identity in relation to social media. In order to integrate Twitter into the unit, but not as a tool which is formally mandated or assessed, Twitter is explicitly introduced during the second module, in the unit material and lecture relating to social networks, which takes place half way through the unit. In introducing Twitter, students are encouraged to sign up for the service (if they have not done so already), to try making at least one tweet, and to search for other tweets which are marked with the unit hashtag #web101. A hashtag is simply a shared piece of text, beginning with the # symbol, which, initially set up through social convention among Twitter users, serves to group tweets together in a manner easily searchable. So, most tweets which are marked #web101 are made by students or teachers in the Web Communications unit.³ (See Figure 1 for an example of tweets using the unit hashtag). Prior to the explicit introduction of Twitter, both myself as unit coordinator and one of the tutors started using the #web101 hashtag to share resources and mention the unit, and any existing Twitter users enrolled in the unit quickly noticed and could engage before the mid-unit introduction.



³ At least one other group, a US based 1-day technology course, used the #web101 hashtag concurrently with Web Communications students. While I was concerned this might lead to some confusion, students were universally able to identify which tweets related to the unit, using the hashtag, and which related to the other course. (The time difference between the US and Australia helped since the bulk of the US tweets took place during the Australian night and early morning.)



Figure 1: Screenshots of Twitter feed searching for the hashtag #web101

In order to gauge the effectiveness of Twitter in encouraging informal learning and enhancing student engagement, the way Twitter was used by two concurrent cohorts of Web Communications 101 was tracked in semester one, 2010. The first cohort was based on the Curtin campus, in a blended mode, including traditional face to face tutorials, combined with lectures, online resources, readings and course material, while the second cohort took the unit via Open Universities Australia and all of their interactions were online. All tweets made using the #web101 hashtag were tracked during the 13 weeks of the unit and notes were kept about the frequency and type of tweets being shared. Both cohorts were asked to complete a short quantitative online survey to broadly measure the ease, depth and relevance of Twitter use in the unit. Lastly, a qualitative follow-up email interview was conducted with a small group of the more active Twitter users, all of whom were enrolled in the OUA version of the unit.

Evaluation, analysis and discussion of Twitter use

In order to evaluate the use of Twitter by students across two concurrent cohorts, a number of methods were employed. Firstly, all tweets with the #web101 hashtag were tracked using Google's real-time search function⁴, from the first day of the unit until two weeks after the unit ended. The types of tweets were analysed in order to see what sort of activities and tweets were most common. Secondly, students were asked to complete a quantitative online survey. For the OUA cohort, 53 students completed the online survey, from a unit with an enrolment of 144 students, with thus a 37% response rate. For the Curtin campus based students, 74 students out of 155 enrolled completed the survey, with a 48% response rate. The higher response rate from campus based students was likely due to the fact that the survey was available to complete in hardcopy during tutorials or online, while OUA students only had the online option. Thirdly, eight of the most frequent Twitter users were identified and invited to respond to a qualitative

⁴ Unfortunately due to contractual changes in the relationship between Google and Twitter, this service no longer tracks tweets so is no longer a viable Twitter research tool. However, other tools are available which can track Twitter and other social media more methodically (see Bruns, Burgess, Highfield, Kirchhoff, & Nicolai, 2011).

interview about their use of Twitter by email; four students responded, with a response rate of 50%.

One of the initial concerns when integrating any technology or online tool into teaching is the time needed to situate and explain that tool. That said, 86% of OUA students surveyed indicated that they found Twitter straightforward and understandable to use, while 77% of the Curtin campus students reported the same results. Comparatively, less than 10% of the OUA students indicated some challenge in using or understanding Twitter, whilst under 20% of Curtin campus students indicated similar issues (several students offered no opinion, possibly those who avoided using Twitter altogether). For a relatively new technology that was introduced using one paragraph of course notes and 10 minutes of explanation in a lecture, the very high numbers of students who found Twitter easy to use and understandable is definitely a positive feature of the service. Twitter has always been deliberately streamlined and this approach makes it less threatening and relatively easy for students to understand.

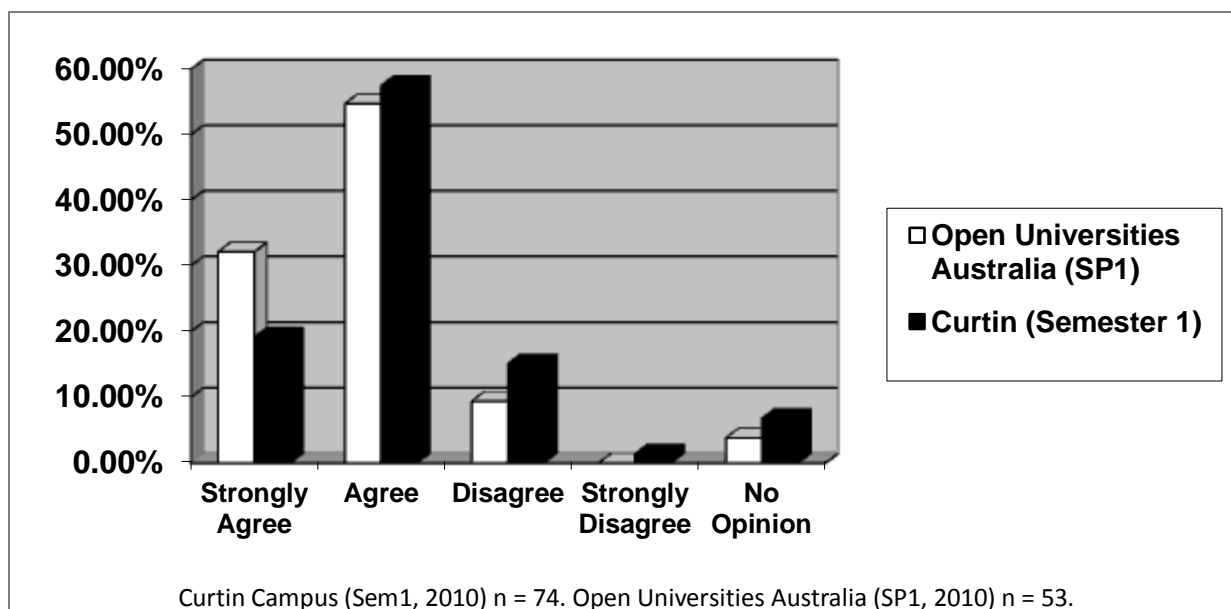


Figure 2: I found Twitter straightforward and understandable to use

Having established that Twitter is relatively easy to use, the number of tweets is also highly important. The archive of tweets using the #web101 hashtag for the duration of the unit ended up containing 242 tweets, with approximately a quarter of those made by the unit coordinator or tutors in the unit. When surveyed, 64% of OUA students found the hashtag useful in locating their fellow students (15% did not, while 21% had no opinion) while only 45% of Curtin campus students found the hashtag useful, with 20% responding negatively and 35% having no opinion – quite possibly this group did not use Twitter at all (see Figure 3). Tweets by students were generally one of three types: **social**, introducing themselves, chatting about life outside the unit, or even arranging face to face meetings in cities with a significant number of students; **resource-sharing**, mainly with students highlighting links to current resources, news items, blog posts or other material

relevant to the unit; or **questions** either asked of anyone listening, or specifically directed at tutors or the unit coordinator. While 242 #web101 tweets ostensibly appear a very small number, closer observation revealed that most students who used Twitter over a sustained period stopped using the hashtag when having social discussions, reserving it for sharing of relevant links or for flagging messages intended for tutors or the unit coordinator. After an initial flurry of social and introductory messages in the first two weeks of the course, mainly from OUA students (and two Curtin campus students), social exchanges rapidly stopped using the unit hashtag. A second set of social and introductory tweets occurred in the week that Twitter was formally introduced in the teaching material, but again use quickly shifted toward link sharing and tutor-directed questions, with social conversations not using the hashtag.

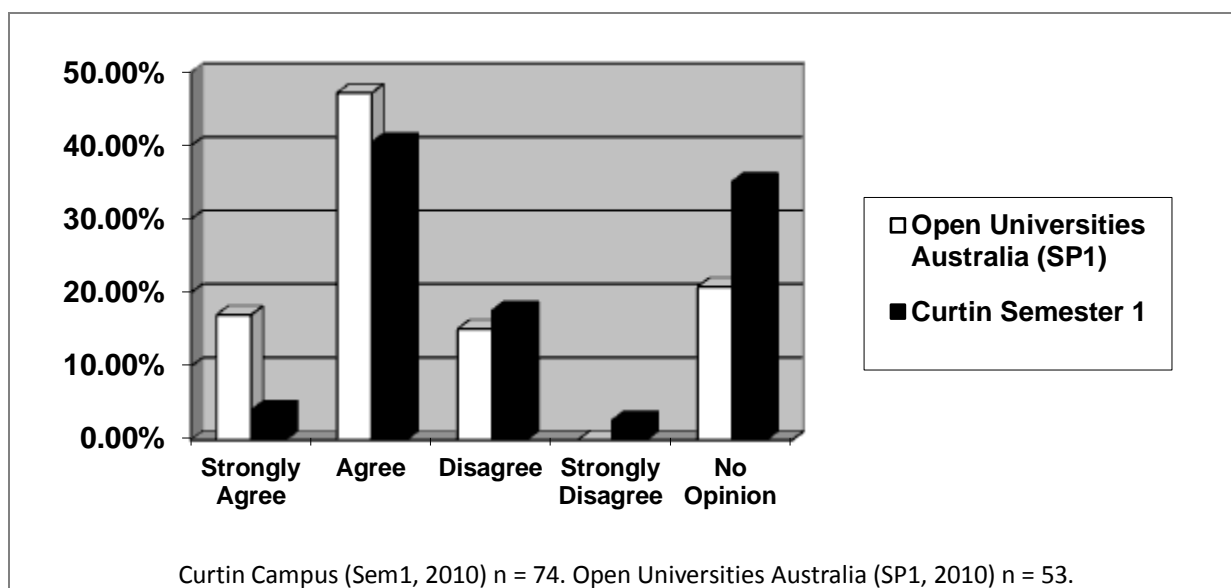


Figure 3: I found the #web101 hashtag useful in locating my fellow students on Twitter

One Twitter function that was not emphasised in the unit material, but students deployed on their own terms, was the use of Twitter lists. A list allows any Twitter user to build a list of other Twitter users and to view the resulting tweets by themselves. In some ways this is similar to a hashtag, but rather than indexing specific tweets, a list combines the tweets from a specific set of twitter users. Both the unit coordinator and some of the more prolific Web101 twitter users set up lists of all self-identified Web101 students (i.e., anyone who had used the hashtag); since public lists can be viewed by anyone, not just their creator, lists became a default view for many of the active Twitter users. This was positive in terms of informal learning for many students, since this grouping allowed social bonds to form more easily. As one student commented:

I got a sense of community. By using Twitter . . . I didn't feel I was working alone online. The sense of community and the support of groups I joined was very helpful, in terms of sharing ideas on the course, and in voicing our concerns for various assignments. (Student 4)

A rough count indicated that there were at least ten times more tweets (in excess of 2000) made by students chatting with each other, having found each other using the hashtag, but only using it once or twice socially and thereafter only, if at all, when sharing relevant resources. From the qualitative responses, one student specifically highlighted that while this social interaction had benefits, it could also be overwhelming:

There were several people who used it [Twitter] as a chat channel which resulted in a flood of tweets that made it hard to keep up, and resulted in only about 10% of what appeared in that account being actually useful/interesting. . . . As the lecturer and tutors were all active on Twitter, and some students were asking questions that were being answered via Twitter, I felt I couldn't ignore it but I didn't feel that the #web101 hashtag was actually used enough to make it worthwhile following, too many Q&As didn't use it so I waded through the lot. (Student 3)

Having not explicitly established that any new information would be replicated on the Blackboard discussion boards, some students felt they had to track the Twitter conversations. While the tutors and I (as unit coordinator) never released information exclusively on Twitter, this response makes it clear that any communication practice needs to be explicitly stated, not left implicit.

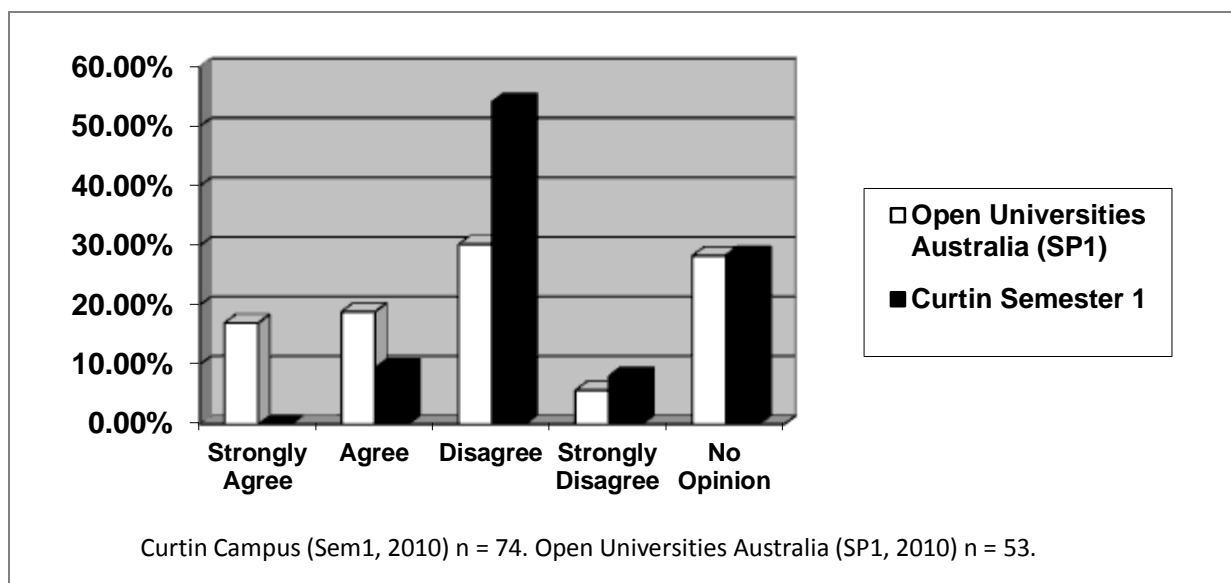


Figure 4: My use of Twitter during this unit strengthened the sense of community between myself and my peers (fellow students)

When responding to the statement “My use of Twitter during this unit strengthened the sense of community between myself and my peers (fellow students)” 36% of OUA students responded positively, 36% responded negatively, while 28% had no opinion. Amongst, the Curtin campus students only 10% felt Twitter had increased their sense of community, with 62% responding negatively and 28% having no opinion (see Figure 4). The mainly negative or indifferent response from campus based students is not surprising since their face to face tutorials would almost certainly provide more regular and sustained opportunities for engaging with each other and forming a sense of community,

if one is to emerge. While 36% might at first glance appear relatively low for the OUA students, with more than a third of the students in the unit stating that Twitter did strengthen their sense of community with their peers in the unit – and keeping in mind that Twitter use was entirely optional – this is actually quite a positive response. Given the wide range of people who study online through OUA, there will always be a significant number of time-poor students who do not wish to engage beyond the immediate unit material and assessments. For 36% of responding students to enhance their sense of community, this suggests that for those who are after a richer student experience, Twitter is definitely a tool which makes a significant contribution in facilitating that connectivity. More to the point, for those students who did engage, they appeared to engage deeply, using Twitter frequently for informal learning and social interaction more broadly. As one student explained:

Twitter was my 'first port of call' in learning online. Having direct access to the tutors and lecturer was invaluable and felt tantamount to the same kind of physical access one would have on campus. I was able to ask simple questions and reliably get almost immediate responses from both faculty and students. It also made everyone more approachable by adding a social element. When your entire interaction takes place with people on an asynchronous message board, it's near impossible to develop any kind of friendship but on Twitter, everyone is friendlier so I got more out of the discussions. In my experience, having a casual, informal place to explain to each other, in layman's terms, the content of the unit, made learning possible where it wouldn't have been otherwise.
(Student 2)

Reinforcing this point, in the responses to a similar statement – “I found Twitter a useful communication tool for engaging with my peers (fellow students) and/or the tutors and unit coordinator” – 53% of OUA students responded positively, 35% negatively and 12% had no opinion, while only 26% of Curtin campus students responded positively, the majority, 57% negatively, with a further 17% having no opinion. From the survey and qualitative responses, it appears that Twitter use can definitely enhance student engagement for those students studying online who seek or value the more social elements relating to learning experiences. Conversely, students who meet face to face on campus tended to see less value in Twitter socially since they (presumably) had sufficient access to social interaction in tutorials and other face to face interactions on campus.

While Web Communications 101 introduces a number of different web-based communication tools, we deliberately set the parameters for students' exploration as broadly as possible, encouraging them to embrace knowledge networking and seek out any web-based tools that may be useful, beyond those explicitly mentioned in the unit materials. This was encouraged by the assessment which required the demonstration of some web-based tools as nodes in a personal website, and also a learning portfolio where students could reflect on any web-based communication. For some students, especially those who were active socially on Twitter, the freedom to explore opened even further opportunities for informal learning and knowledge networking. As one student explained:

During my discussion with one student, we ended up going into Donut [an alternative chat-based social media tool] to complete the discussion because the 140 character limit was an issue. . . . The chatroom was a fantastic place for brainstorming assignments, discussing module and lecture information on a weekly basis and touching base in 'real time' with other students who were often as lost as me at times. (Student 1)

When these students sought out and discovered alternative online communication tools based on the exact affordances they needed, they embodied the unit philosophy about individual exploration of these tools, an important element of self-propelled learning. Anecdotally, having followed the trajectory of a number of these students for over a year, these students have embraced other tools as well, creating their own Facebook discussion groups, Facebook and Twitter groupings for other units and so forth. While investigating these in depth should be the subject of future research, it is nevertheless key to evaluating Twitter in this instance to see that it inspired students to embrace informal learning opportunities which were not restricted to a single unit, but persisted for many students for the duration of the degree which they are studying. In many ways, this is the most important thing about student engagement; these ties can last far longer than any single unit, and seeing online students self-organise social and support opportunities that persist is highly significant in them helping each other enjoy learning online with the same opportunities as campus based face to face students.

While there are a number of positive aspects evident from student responses, the clearest area which needs more work and attention in future versions of the unit, is the setting of clear boundaries. As noted above, even though Twitter use was optional in the unit, some students presumed information might be released by the unit coordinator or tutors that was not available on the official Blackboard discussion boards. This was not the case, but the fact that a student might presume this is a clear indication that an explicit statement is needed about the bounds and nature of use of Twitter, or any other communication tool, in the unit (especially since the teaching staff were present on Twitter). Similarly, most of the tutors and I used our regular Twitter profile to interact with students, but it quickly became evident that it was impossible to escape student contact at any point we used the Twitter service. For example, if I was using Twitter to interact with colleagues or share professional resources on a Sunday evening, then a student may notice my tweets, then ask a quick question; at first, one or two quick replies does not feel like a lot of work (especially since they could be no more than 140 characters), but quickly over the duration of the semester, Twitter became a place where students were always present. As unit coordinator, with a full-time position, this was manageable, but for tutors who are paid for a set time or amount of engagement, the boundaries were harder to identity and maintain. In future uses, either specific times for engaging with students, or possibly creating a second account specifically for interactions with students might be a good idea. That said, as previous research suggests tweets with some social information lead to more credibility (Johnson, 2011), a second account may lose this element. Indeed, the tension

between sharing social information while trying to maintain a professional approach is also evident in this student comment:

The only thing that got me thinking, towards the end of the unit, was a situation I was in where I disagreed with one of the tutors via one of the informal social media tools, about something that was completely outside of the course outline. I alternated between wanting to fully express myself, and being worried that doing so would impact on what was happening within the course. Probably it didn't but that's one of the issues with entirely-online communications - it's sometimes difficult to gauge how far you should go in certain situations without seeing faces and expressions. (Student 3)

Here the student's comment is a clear reminder, that while social elements may be important for credibility and engagement, they need to be carefully managed and considered if Twitter is a tool for discussions with students. Students can generally self-police what they choose to share, but having clear boundaries and expectations from tutors and the unit coordinator will likely contribute to a smoother and more sustainable use of Twitter and similar tools in this and other units.

Conclusion

Twitter is not a single solution in the quest to enhance student engagement or increase informal learning opportunities, but from the responses outlined above, it is a tool which, when deployed successfully, can make a valuable contribution, especially for students studying online. This small study suggests that in terms of student engagement, Twitter uptake will be higher amongst students who lack face to face opportunities to interact. In addition, four clear guidelines have emerged for effectively setting up Twitter use in a unit with the intention of encouraging informal learning:

1. **Use a hashtag.** Establish a hashtag before integrating Twitter into a unit, and check that your chosen hashtag is not already being used. While students may only use a hashtag initially to introduce themselves, it is vital as it allows every person using Twitter in a unit to identify themselves and find each other. However, in terms of tracking students using Twitter, just archiving tweets with the hashtag will probably be inadequate since social interaction between students is unlikely to use an established unit hashtag.
2. **Model Twitter use.** As many students will be unfamiliar with Twitter, having the unit coordinator or a tutor model Twitter use – sharing resources, welcoming new unit users to Twitter and so forth – establishes and reinforces best use in relation to a unit or course.
3. **Encourage students to explore other tools.** If the aim is to encourage student interaction, then giving them the freedom to explore other tools, and use them, may allow other spaces for student engagement to emerge organically.
4. **Set clear boundaries and parameters.** How often will tutors or unit coordinators tweet? Will they always reply to students or only at specific times? When should a comment be directed back to the official discussion boards so

students not using Twitter can see the answer? Should teaching staff use a new Twitter account or use an existing one? Answering these questions in advance, and sharing that information with students, will ensure that Twitter (or any other communication tool) is used in a way that suits teachers and learners. Clear expectations are always paramount in clear communication.

While the use of Twitter will always be context-specific, these guidelines will assist in thinking through the appropriateness of this or other communication tools. Broadly, though, in gauging whether Twitter can be a useful tool for enhancing student engagement and facilitating informal learning, the final word has to come from a student:

Learning online is excellent for the academic side of things, but a large part of the university 'experience' comes from the friendships that are made. This aspect of university online isn't really dealt with in any way through the official communications which, for me at least, seems like an enormous waste. I know that many students seem to learn better when they are connected to others and are learning with friends. Encouraging or requiring some kind of social interaction through social media tools would be a big step towards achieving this. (Student 2)

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[Escholar 2010 – Tama Leaver – Case Study Video](http://youtu.be/5LmWnJg9800)

<http://youtu.be/5LmWnJg9800>

e-Review Program: An alternative online interaction for a first-year unit of Engineering Mechanics using a virtual classroom

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KEYWORDS

Virtual classroom, e-review, graphics tablet, online interaction

Abstract For large first-year units such as Engineering Mechanics 100, a lack of close interactive consultations between individual students and lecturers, and opportunities for weekly topic reviews precludes the enhancement of effective learning outcomes. Such drawbacks can lead to students' disengagement that ultimately results in their academic underperformance. This e-Review project investigated the effective use of an alternative flexible learning method in which the interactive online teaching tool *Elluminate Live* was combined with a visual-aid graphics tablet to conduct the weekly e-Review sessions and revisions of past-semester examination questions. As opposed to the conventional in-class review in unit teaching, the difference of the e-Review program lies in its convenient electronic access to unit revision activities through the monitoring of lecturers (as moderators) in a virtual classroom. It is shown that the use of *Elluminate Live* offers supplementary academic support that is beneficial to students through more direct feedback than can be achieved in a real class. Students also recognise the higher utility of e-Review materials that allow for subsequent viewing of recorded e-Review sessions.

Background

Engineering Mechanics 100 (EM100) is a core unit in the Engineering Foundation Year (EFY) program at Curtin University. The unit is taken by a large cohort of students, totalling over 300 at the Bentley campus, and some 180 at the Miri campus (East Malaysia) in each semester. There are three major unit assessment components including laboratory practical tests (30% weighting), in-class quizzes (20% weighting) and a final examination (50% weighting). Large-class lectures, a high student-to-staff ratio, and limited opportunities for individual interactions and feedback from lecturers inevitably impede the goal of effective teaching and learning outcomes. Additionally, time constraints, coupled with the need to cover an extensive range of mechanics topics, mean that students are not exposed to sufficient review of, or reflection upon, the lecture materials and topic revisions to meet their individual learning-development goals. The typical feedback mechanism by which students can be appraised of their progress is

through the in-class quizzes that are normally conducted for 10-15 minutes in their weekly tutorial classes with small study groups (typically 25 students). However, according to Curtin eVALUate (the student online learning feedback system) results (EM100 eVALUate USR, Semester 1, 2011 & EM100 eVALUate USR, Semester 2, 2011), EFY students reported that insufficient time was spent on completing the in-class quizzes. Additionally, late attendance due to a class swap from other campus venues and absences owing to sickness or family issues can also adversely impact on the self-evaluation of students' study progress though mark allowance is granted for legitimate absences in a student's overall assessment mark.

In order to remove all of the aforementioned barriers to effective learning encountered by EFY students, a supplementary virtual classroom for EM100 was set up with the aids of Elluminate *Live*, an online education tool, and a graphics tablet for the 2011 e-Scholar program. As participants in this e-Review project, EFY students enrolled at Bentley and Miri campuses in Semesters 1 and 2, 2011 were encouraged to use this sophisticated facility for the four-week Dynamics module (teaching weeks 7-10). Dynamics is the second section of EM100 in addition to Statics and Fluid Mechanics being the first and third teaching modules. The development of e-Review sessions was structured as a 'practice' or 'trial-run'. Accordingly, it was not made compulsory and students' participation did not attract any unit assessment marks. After the four-week trial period, an online survey of students' experience and views on the e-Review program was conducted via SurveyMonkey in which students' voluntary participation entered them into a prize draw.

Rationale

The use of Elluminate *Live* to establish a virtual classroom is a potentially valuable addition to unit delivery in that it allows for peer-to-peer interactions and live consultations with lecturers that are likely to enhance personal motivation and self-development of students, and their flexible learning options unconstrained by the physical and timetabling obstacles to which traditional learning approaches are subject. More specifically, it was anticipated that the e-Review program would permit the step-by-step demonstration of unsolved worked examples, reviews of previous week's topics and entire module revision. There are missing components in large-lecture classes due to time constraints; neither can such components be covered adequately in the weekly quizzes that test basic Dynamics concepts. Ultimately, the successful conduct of this project would significantly enhance and encourage multi-faceted learning and mixed educational approaches in alignment with Curtin's blended and flexible learning developments.

Literature review

Distance e-learning and online education have become a new delivery mode at tertiary educational level enabled by the advancement of current information technologies. To meet recent educational challenges encountered such as classes with large student

numbers, growing curriculum content (as knowledge and techniques inexorably advance), and limited face-to-face consultation time with lecturers, the introduction and use of functional e-learning platforms and tools are essential to achieve reciprocal benefits for students and lecturers.

Garcia et al. (2007) summarised the range of existing commercial platforms and tools for synchronous distance e-learning. Amongst all of these, Elluminate *Live* academic edition emerges as a very powerful and popular package in multi-media, many-to-many, collaborative, online education. Murphy and Ciszewska-Carr (2007) highlighted the needs to enhance student-student interactions using the two-way audio and direct messaging in Elluminate *Live*. By analysing the teaching strategy using both Elluminate *Live* and HorizonLive, Barron et al. (2005) found that 83.3% of students almost always felt more connected to others in their class and 75% felt almost always more connected to instructors. On the instructor side, their satisfaction rate with teaching with technology, in particular their experience with using Elluminate *Live*, was also quite high (60% for 'very satisfied' and 40% for 'satisfied'). Crofton et al. (2007) gave general guidelines on implementing Elluminate *Live* and tablet PC to deliver a hybrid course in the University of Kentucky-Paducah's Extended Campus Engineering Program. As a joint engineering program between the University of Kentucky and Murray State University, its virtual-class application facilitated lecture delivery via Elluminate *Live* and offered an alternative to commuting between different campuses required by the traditional teaching mode. The experience of a non-traditional student, attending lectures in mechanical and electrical engineering from work or home, has been compared with those of a traditional student attending on-campus lectures to assess whether Elluminate *Live* can serve as a substitute means of lecture delivery. The results suggested that Elluminate *Live* is an extremely effective resource as a supplementary tool to lectures, but could not completely replace the traditional dynamics of lectures. Fuller (2009) focused on student engagement in large classes using Elluminate *Live* in order to facilitate the provision of real-time interaction, collaboration and group meetings. A core subject within the Bachelor of Business at the Queensland University of Technology (QUT) with an average enrolment of one thousand students per semester in 2008 and 2009 used Elluminate *Live*. The survey was conducted based on sampling data of 75 students who participated in the *I have used Elluminate Live survey* and 108 students who participated in the *I have not used Elluminate Live survey*. Elluminate *Live* was found to be a more flexible means of accessing academic support with more than 90% student agreement. In this study participants also found Elluminate *Live* to be an overall satisfactory teaching tool with 96% student agreement, which helped 'more than expected' to improve student learning in the subject (80% student agreement).

Research objectives

The purpose of this project was to evaluate the feasibility and usefulness of integrating Elluminate *Live* in combination with a graphics tablet as an online learning tool for the Dynamics module in EM 100. The detailed objectives of this project were to:

- Assess interactive/collaborative learning and usefulness levels of Elluminate *Live*;
- Determine the impact of an e-Review program on students' learning experience and outcomes in the Dynamics module; and
- Evaluate the online learning flexibility and helpfulness of recorded e-Review sessions.

Project set-up and methodology

Elluminate Live platform

Elluminate *Live* is one of the most readily used virtual-classroom software packages because the online teaching and learning environment requires just an internet connection and computer speakers (for receivers) as basic settings. From the moderator's point of view, it is a cross- platform web-based technology enabling the use of peripherals including a webcam, a microphone and a graphics tablet. The basic idea is to transfer face-to-face sessions from a physical environment to an online virtual educational environment for relatively small study groups as opposed to real large classes so that collaborative communication can be more efficiently established, thereby facilitating an enhanced student learning experience. A typical Elluminate *Live* interface is depicted in Figure 1, which shows four main built-in windows. The functionality of the Elluminate *Live* interface as used in the e-Review project is described as follows:

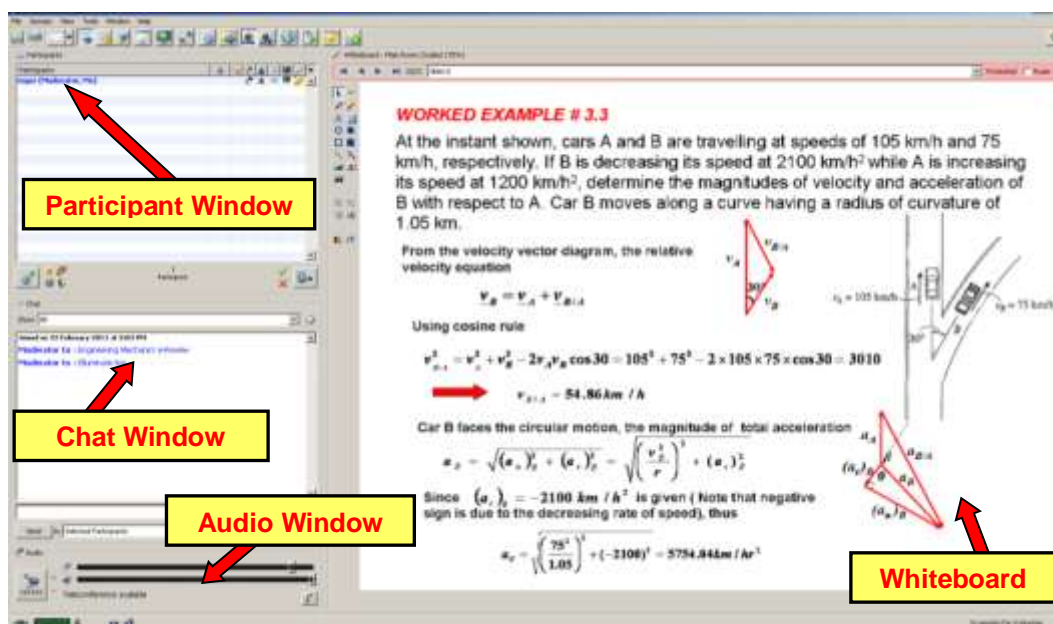


Figure 1: Four built-in window features on Elluminate *Live*

- **Participant window:** This window provides a list of all participants and moderators in the online session and indicates their current activities ranging from audio speaking, sending chat messages, entering texts for close-captioning, using the whiteboard drawing tools, graphing calculator, application sharing, video webcam and file loading features.

- **Chat window:** This window enables sending and receiving text messages directed to one participant only, selected participants, moderators and/or all participants. Messages could be filtered, time-stamped, printed and saved to track session communications.
- **Audio window:** This window is used for participants and moderators to converse with each other. Normally a microphone with built-in speakers or headset and a computer sound card are required.
- **White board:** This window is used to load PowerPoint presentations which can be annotated by moderators and/or students. In addition, moderators can draw figures/diagrams and write annotations on the white board with or without the use of a graphics tablet (Elluminate Live V 10 Moderator's Accessibility Guide, 2010).

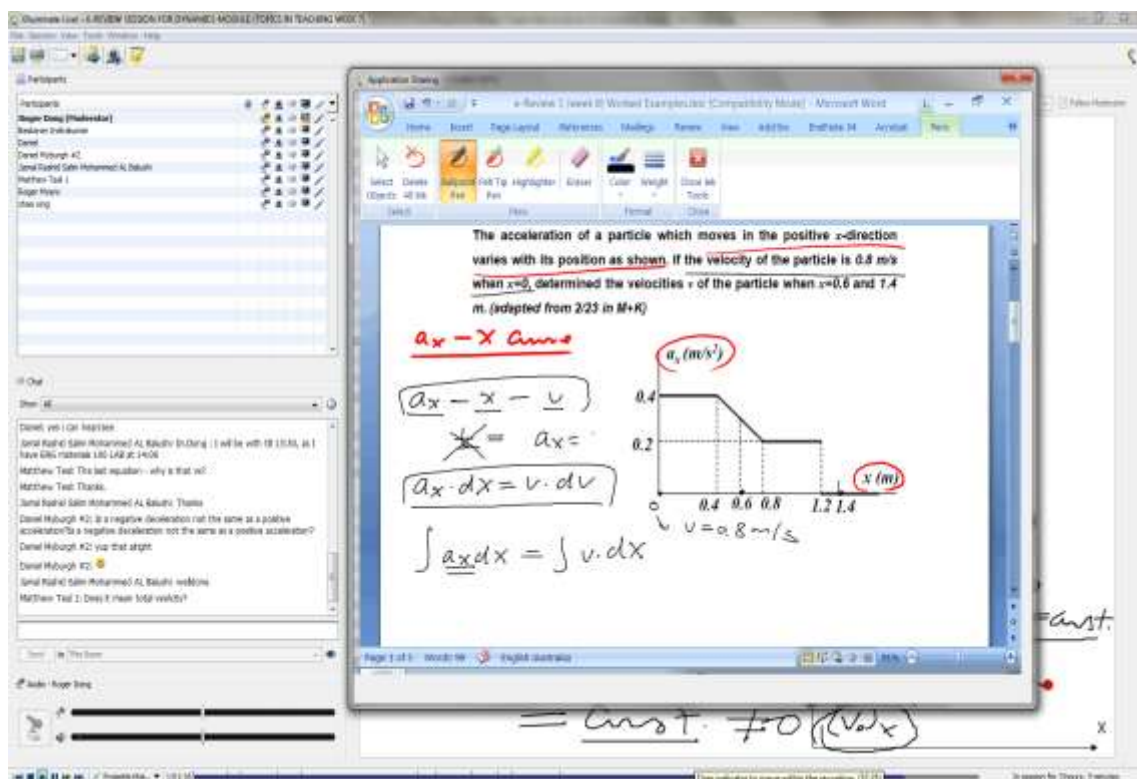


Figure 2: Application sharing an MS Word document on Elluminate Live

Other important features supported by Elluminate Live are a webcam function for moderators and participants to view one another during the initial introduction and question time as well as to display the contents in a pre-loaded MS Word, MS Excel or MS PowerPoint file during application sharing. The application-sharing feature was particularly important for demonstrating the Dynamics worked examples in a MS Word document with the utilisation of a graphics tablet, as is illustrated in a typical example in Figure 2. Furthermore, index recording and playback functions were enabled to help students unable to attend certain e-Review sessions to view recorded live sessions as many times as they wish.

Since Elluminate *Live* is integrated with Blackboard, the online learning management system at Curtin University, scheduling and set-up of the e-Review program was very simple as it is embedded within the unit's Blackboard site. Students were informed of the pre-arranged timetable of e-Review sessions in each semester via a Blackboard announcement. The direct link to each session was supplied to students as an alternative entry into sessions, if they experienced problems with logging into Blackboard. Firefox was the recommended web browser for reliable interface access owing to an integrated Java program used when running Elluminate *Live*.

Graphics tablet

A WACOM graphics tablet DTF-720 with a 17 inch LCD interactive pen display screen was employed to further enhance the e-Review program. A cordless and battery-free stylus pen with the support of WACOM Pen Tablet Driver was also applied to make annotations, draw diagrams and figures, and demonstrate worked calculations on the white board and in shared MS Word documents, respectively.

Online questionnaires using SurveyMonkey

A wide range of survey questions to assess the effective use of Elluminate *Live*, the impact of e-Review on learning outcomes, and the flexibility of e-learning as compared to traditional learning approaches were set up using SurveyMonkey, an online survey tool for creating, collecting and analysing data (www.surveymonkey.com). The SurveyMonkey interface used in the e-Review project is shown in Figure 3. Ethical approval for the online survey was granted by the Curtin University Human Research Ethics Committee for Semesters 1 and 2 2011. All students ($n = 431$ in Semester 1, 2011 and $n = 516$ in Semester 2, 2011 at both Bentley and Miri campuses) were invited through a Blackboard announcement to complete this survey with a prize draw. However, only 3.5% ($n = 15$) in Semester 1, 2011 and 5.4% ($n = 28$) in Semester 2, 2011 responded. Considering the small group size (normally less than 20 students for the interactive communication) for the Elluminate *Live* sessions, it was still deemed worthwhile to perform an explicit statistical analysis of the survey data in this proof-of-concept study. Such analysis combined the data obtained from both semesters and mainly targeted EM100 students who either participated in e-Review program or viewed the recorded e-Review sessions.

Curtin University Full this survey

e-Review Program Survey for Engineering Mechanics 100

20%

Thank you for taking the time to complete this survey on the e-Review program in the Dynamics module of Engineering Mechanics 100 by the School of Civil and Mechanical Engineering at Curtin University. Your feedbacks and comments are very important to us and will assist us in improving this teaching unit in the future.

The purpose of this survey is to investigate whether the e-review program using the virtual classroom via Elluminate Live has improved your blended learning experiences (motivation, engagement and understanding) in the dynamics module of Engineering Mechanics 100.

This survey should take less than 10 minutes to complete. Your answers will be completely anonymous and by filling out our survey you will be entered into a draw for a \$50 iTunes card. All results from this survey are confidential and will only be used for research purposes.

If you have any questions please contact Dr. Yu (Roger) Dong, Unit Coordinator for Engineering Mechanics 100 on (08) 9265 9055 or by email Y.Dong@curtin.edu.au.

Q1. Please select your age range:

- ☐ Under 21
- ☐ 21-30
- ☐ 31-40
- ☐ 40+

Q2. Do you agree or disagree with the following statement:

"The unit review of Engineering Mechanics 100 (including the past exam questions) by lecturers is important."

- ☐ Strongly agree
- ☐ Agree
- ☐ Disagree
- ☐ Strongly Disagree
- ☐ Not applicable

Q3. Did you participate in the e-Review program for the Dynamics module of Engineering Mechanics 100?

- ☐ Yes
- ☐ No

Figure 3: Online survey questionnaire using SurveyMonkey

Project methodology

The e-Review program was conducted in two consecutive semesters in the 2011 academic year from April 20 to May 25 for Semester 1 and from September 7 to October 19 for Semester 2, utilising a project methodology that comprised the distinct phases of pre-processing, project operation and post-processing as detailed in Figure 4.

In the pre-processing step, an initial literature review relating to online learning via Elluminate *Live* was undertaken to inform the investigation, followed by the set-up of survey questions and document preparation for ethical approval, and completed by the establishment of the online questionnaire using the SurveyMonkey system. The questionnaire was designed to include 20 different types of questions ('single/multi-choice', 'level-ranking' and 'directly answered') with a main focus on the user-friendliness of Elluminate *Live*, enhancement of effective learning as a result of specific features on Elluminate *Live*, students' experience, and suggestions about the e-Review program. Students were advised that the anonymous survey would take approximately 10 minutes to complete. The first step was mainly completed by the project investigators prior to semester commencement.

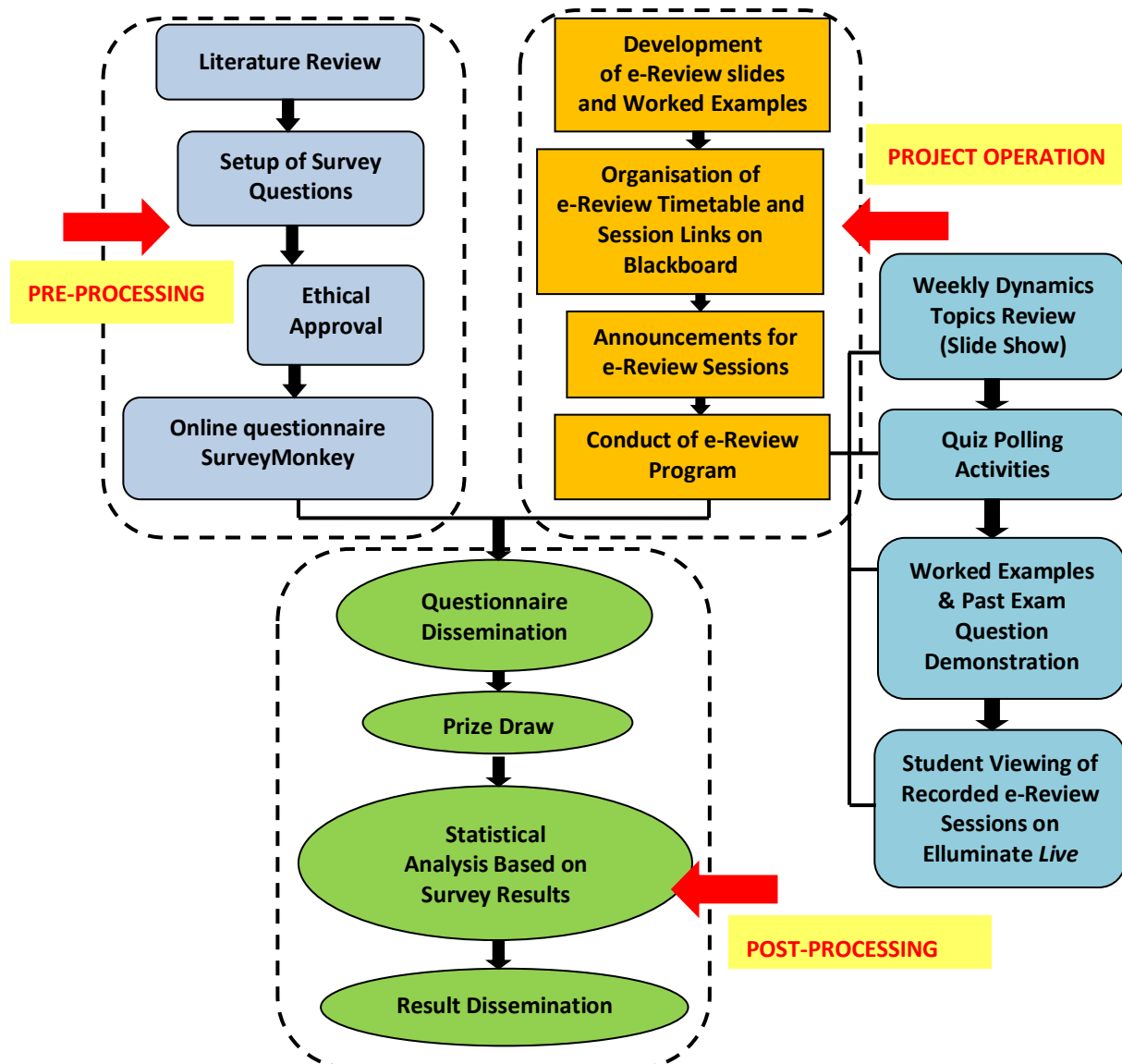


Figure 4: Flowchart of project methodology

In the second step of the project, e-Review PowerPoint slides, simple quiz questions and worked examples associated with their detailed solutions were developed. Thereafter, the timetable (mainly scheduled in students' common free time from 12:30-1:30 pm on Wednesdays) and hyperlinks of e-Review sessions were set up using the Elluminate *Live* tab on Blackboard. These were further publicised via unit announcements on Blackboard and concurrently through email communication using students' accounts linked within Blackboard. The core component of the project's operation was the actual conduct of the e-Review program scheduled on a weekly basis from the Dynamics-module lecturer's office. This weekly component comprised the following activities:

- e-Review of previous week's Dynamics topics (including fundamental Dynamics concepts, theory and important formulae or equations) using PowerPoint slides;

- Student polling activities using simple quizzes in either ‘Yes’ or ‘No’ or multi-choice format that permit students to self-monitor their study progress and understanding;
- Demonstration of fully worked examples (not shown in large-lecture classes) and past- semester examination questions (during study weeks) by using a graphics tablet in a live broadcast via the application-sharing feature on Elluminate *Live*;
- Invitation to individual students to raise questions or post live queries on the ‘chat window’ during/after e-Review and example work-out time, to get immediate clarifications and advice from the lecturer (in the role of ‘moderator’ on Elluminate *Live*); and
- Student viewing of playback videos of recorded e-Review sessions.

In the post-processing step, a Blackboard announcement was made inviting all EM100 students to use the hyperlink to access the e-Review online questionnaire on SurveyMonkey. Those who completed the survey were offered entry into a prize draw of an iTunes \$50 card. Statistical results were automatically generated in SurveyMonkey and replotted using MS Excel spreadsheets prior to their analysis and dissemination.

Results and discussion

Participant number vs. view number

Participant number in the e-Review program is an important factor for gauging the value perceived by students of using Elluminate *Live* as a live educational consultation tool. As observed from Figure 5, the overall participation was quite low being less than five students for teaching weeks 8-10. Nonetheless, relatively high numbers (about 16 and 19, respectively) were detected in the first e-Review session for teaching week 7 and Dynamics examination-question review at the end of semesters. For the former, the high numbers could be attributed to initial interest and the curiosity of students to try out a new and flexible online learning system. The latter peak in participant number may be due to an examination-focused student mindset towards the end of semesters when working on unit revision to prepare for the final examination. Students tended to lose interest or might have been distracted by other unit activities or part-time work during the second, third and fourth e-Review sessions as evidenced by a relatively small participant number. Overall, it appears that the students had greater enthusiasm and self-motivation in their initial attempts but then failed to maintain steady learning habits.

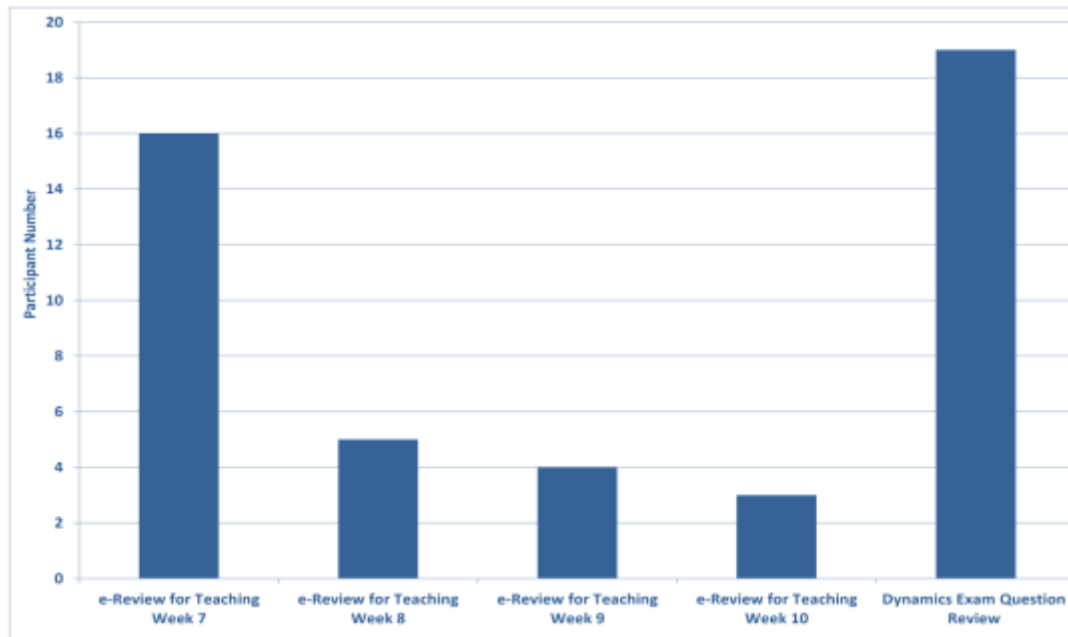


Figure 5: Participant number in e-Review program

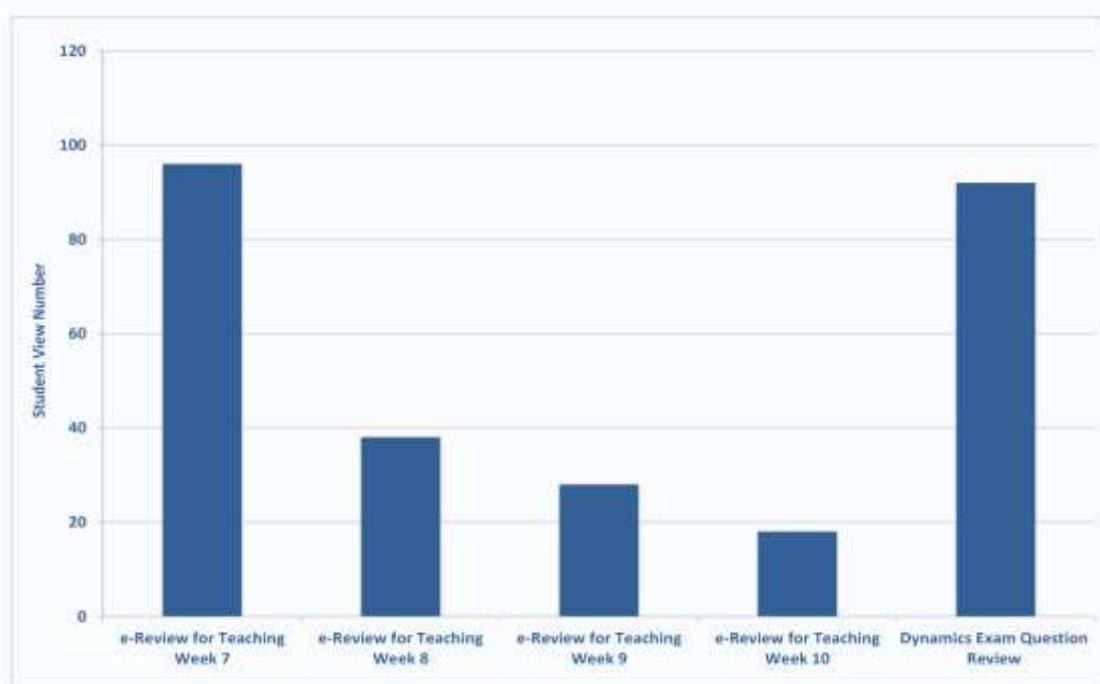


Figure 6: Student view numbers in e-Review program

Like the iLecture system deployed at Curtin University, the view number after recording the e-Review sessions is equally important since this factor can reflect indirect student participation in the program, especially for those who were unavailable during the live consultation sessions held at the same time every week. The counting of view numbers is based on two major criteria comprising the elimination of students with “uninitialised” status (i.e. ‘login fails’) for Elluminate *Live* access and number adjustment for those with multiple login accesses over short periods of time (i.e. treated as one login only) in order

to obtain accurate data for interpretation. As a whole, the view numbers shown in Figure 6 are far higher than the participation numbers seen in Figure 5. This implies that students preferred to view playback e-Review sessions rather than participate at designated time slots. More expectedly, significantly higher numbers of 96 and 92 are seen for the first e-Review session and Dynamics examination-question review, respectively, which resembles the live-participation trend of Figure 5. Additionally, the total view numbers for both semesters monotonically decreased from 38 to 18 between the second and fourth e-review sessions. As a result, viewing the e-Review sessions to play back the recorded lecture sessions, has made a more predominant impact on the attraction of students' study interest.

Survey results

Of the overall survey responses on the SurveyMonkey system, over 86% of the 22 students for both semesters (including 'agree' and 'strongly agree') realised the importance of unit review in EM100. This was the factor that had motivated the introduction of present e-Review program as compensation for the lack of in-class reviews of the Dynamics module owing to time constraints imposed by the need to cover a wide range of topics. This finding confirms that students are still very keen on a 'closed loop' teaching strategy of 'lecture delivery-to-lecture review'.

In terms of learning flexibility, students tended to participate in the e-Review sessions in multi-locations at both university and home (none in the workplace). The predominance of participation from home is clearly evident with 62.5% of 16 students as opposed to 37.5% in the university. This might suggest that students are more keen to be engaged with Elluminate *Live* outside their scheduled lectures and tutorials since additional comfort and convenience could be offered at home. The other point worth noting is that Elluminate *Live* enables those students absent from lectures and tutorials due to family or medical matters to access the live consultations and view the recorded e-Review sessions as attending students. This advantage is unique to online learning with more study freedom and flexibility relative to traditional learning in which attending lectures or tutorials is the only means to attain first-hand information on unit contents and participate in learning activities.

The effectiveness of Elluminate *Live* features on the three enhanced learning aspects including 'interactive learning', 'collaborative learning' and 'a sense of learning community' were investigated with the results shown in Figures 7-9. Given that the scale threshold of 2.5 between agreement and disagreement levels for the positive feature impacts, 'the ability to review an Elluminate recording', 'text chat window', 'white board area' and 'video demonstration (use of graphics tablet)' were ranked as the four most favoured features. In particular, 'video demonstration (use of graphics tablet)' is found to have great potential as an effective visual aid, better facilitating both interactive and collaborative learning.

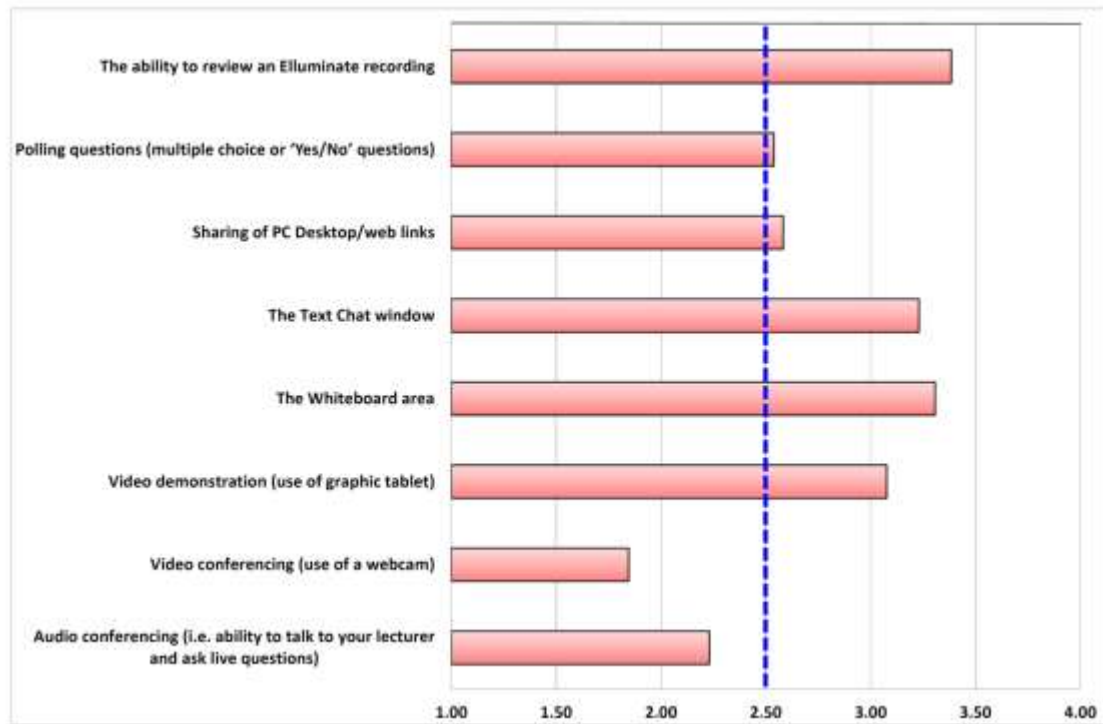


Figure 7: Average agreement levels of interactive learning using Elluminate *Live* features in e-Review program (total response numbers n=13 for both Semesters 1 and 2, 2011 and 1=Low to 4=High for the agreement level). The dashed line represents the scale threshold of 2.5 between the agreement and disagreement levels.

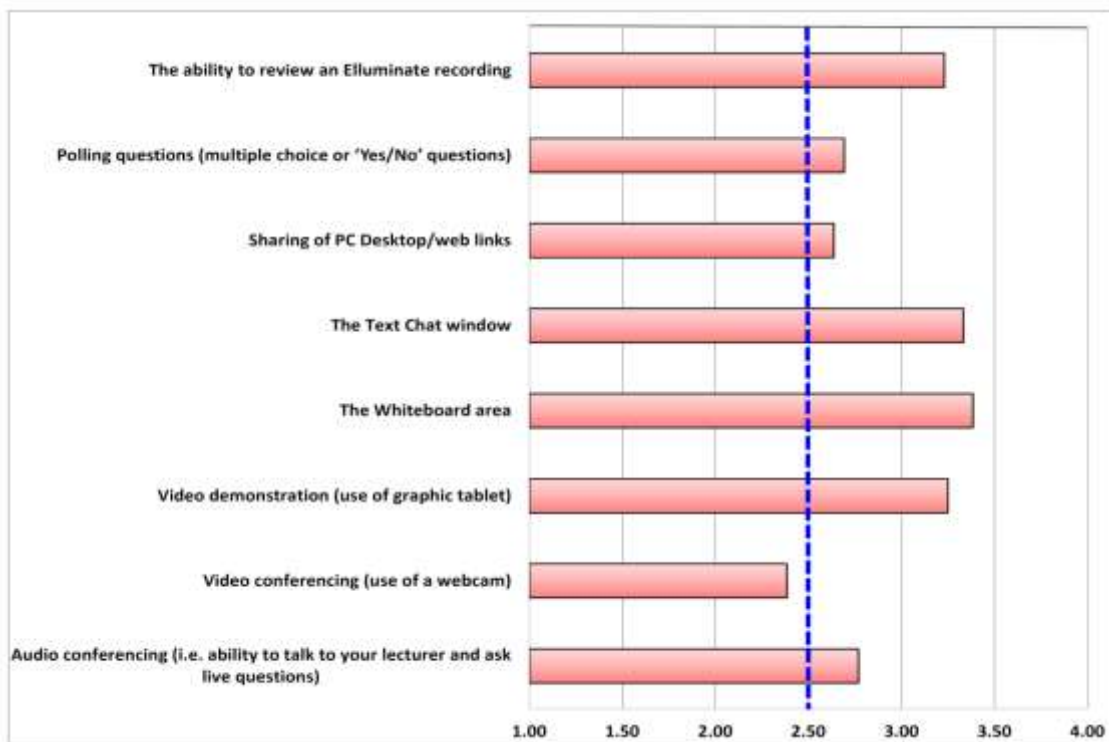


Figure 8: Average agreement levels of collaborative learning using Elluminate *Live* features in e-Review program (total response numbers n=13 for both Semesters 1 and 2 2011 and 1=Low to 4=High for the agreement level). The dashed line represents the scale threshold of 2.5 between the agreement and disagreement levels.

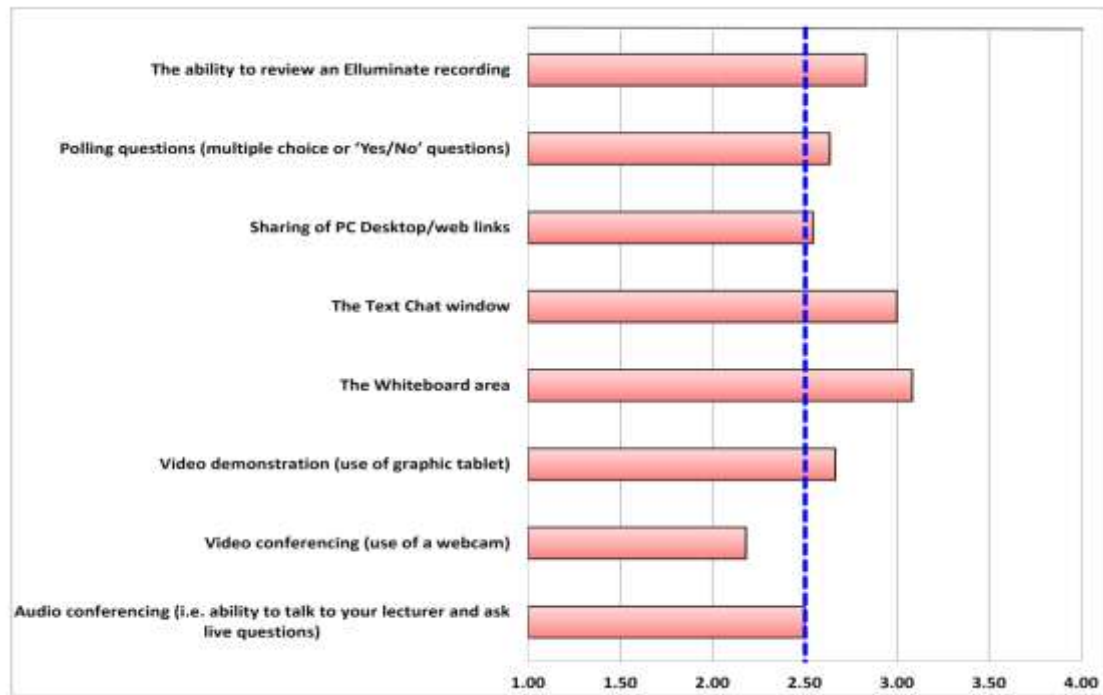


Figure 9: Average agreement levels of a sense of learning community using Elluminate *Live* features in e-Review program (total response numbers n=12 for both Semesters 1 and 2 2011 and 1=Low to 4=High for the agreement level). The dashed line represents the scale threshold of 2.5 between the agreement and disagreement levels.

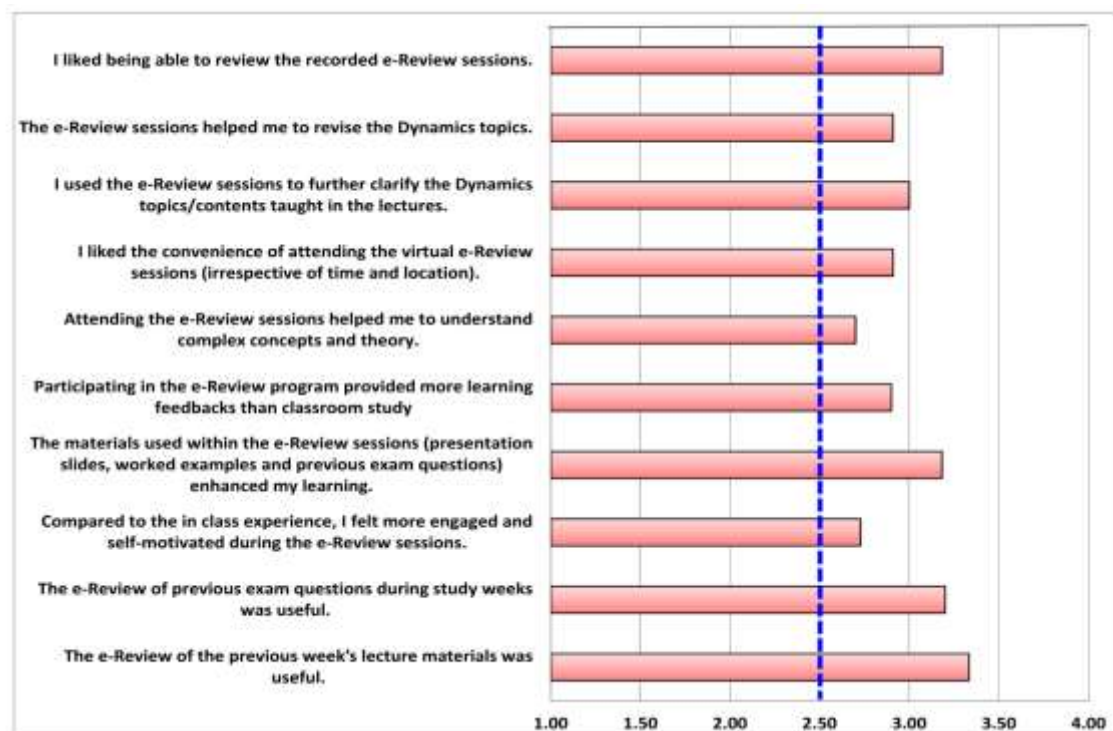


Figure 10: Average agreement levels of student learning experience in e-Review program (total response numbers n= 12 for both Semesters 1 and 2, 2011 and 1=Strongly disagree, 2=Disagree, 3=Agree and 4=Strongly agree). The dashed line represents the scale threshold of 2.5 between the agreement and disagreement levels.

Student learning experiences in the e-Review program are reported in Figure 10 with the same threshold level of 2.5. The opportunity to view the recorded e-Review sessions, enhanced e-Review learning materials and the usefulness of both previous weeks' lecture materials and past semester examination questions are the most noteworthy aspects of program participation. Since the virtual class is a relatively new concept to most of EFY students as compared to the traditional real-lecture teaching, it may take quite some time for students to become comfortable with this online teaching and learning approach, especially for those who instinctively prefer the face-to-face interactions and in-person feedback.

Typical student testimony

Further qualitative insights of student perceptions of Elluminate *Live* as a pedagogical tool are presented here. These comprise typical student comments gathered from various sources obtained through Curtin eVALUate reports (note that USR=Unit Survey Report and TER=Teacher Evaluate Report) and online survey questionnaires:

Usefulness of the e-Review program

"e-quizz, e-review and lab are excellent." (EM100 eVALUate USR, Semester 1, 2011)

"The live e-review sessions were really helpful. Great way to sum up certain concepts and apply them to questions." (EM100 eVALUate USR, Semester 1, 2011)

"e-Review sessions are very useful!" (EM100 eVALUate TER for Yu Dong, Semester 2, 2011)

"The examples and Elluminate are very useful." (EM100 eVALUate TER for Yu Dong, Semester 2, 2011)

"Elluminate has been a very useful tool this Semester...." (EM100 eVALUate TER for Yu Dong, Semester 2, 2011)

"e-Review was extremely helpful and the delivery pace was far better than in the lectures." (Online survey questionnaire report via SurveyMonkey, Semester 2, 2011)

These comments endorsed the implementation of Elluminate *Live* in the e-Review program as a helpful online-assistive educational tool to recap fundamental Dynamics concepts and apply them to the worked examples. The better delivery pace in the e-Review sessions is also acknowledged by students as a welcome balance to the pace of the lectures.

Expansion of the e-Review program to other modules

"I found the e-Review aspect extremely helpful. I think it should be done in Statics and Fluid Mechanics as well." (EM100 eVALUate USR, Semester 2, 2011)

“The most helpful part so far was the Dynamics module only. The questions done during the lectures and the Elluminate are very helpful. Would really be useful for Statics as well.” (EM100 eVALUate USR, Semester 2, 2011)

“If at all possible, please introduce the e-Review sessions for Statics and Fluids!” (EM100 eVALUate USR, Semester 2, 2011)

“Please add e-Review to Statics as well if possible.” (EM100 eVALUate TER for Yu Dong, Semester 2, 2011)

“Please extend it to the whole unit-there may not be time to review Fluid Mechanics but the option to review Statics would have been very helpful.” (e-Review online survey questionnaire report via SurveyMonkey, Semester 2, 2011)

In addition to the students’ positive feedback on the e-Review program for the Dynamics module, students suggested (in the above comments) the expansion of the e-Review program to include the Statics and Fluid Mechanics modules. This point reveals that students have recognised the important role that an e-Review program can play as a supplementary study activity that could benefit all of the taught components in Engineering Mechanics 100.

Conclusions

This chapter has reported on the applicability and potential of Elluminate *Live* for conducting an e-Review program in the Dynamics module of Engineering Mechanics 100, a large-class first-year unit taken by all Engineering students. The statistical data on what was voluntary participation and subsequent viewing of recorded sessions suggest that those students who participated tended to favour the use of the recorded e-Review session over personal participation in the live consultation. Higher participation and viewing number were noted for the first e-Review session probably due to student curiosity about a new teaching and learning technique, and for the last sessions where past-semester examination question reviews were conducted, reflecting students’ assessment-oriented outlook. It was also shown that the Elluminate *Live* platform could contribute to increased flexibility in the learning environment because students predominantly chose to participate or view the e-Review sessions at home.

With respect to the capability of Elluminate features, ‘the ability to review an Elluminate recording’, ‘text chat window’, ‘white board area’ and “video demonstration (use of graphics tablet)” were ranked very highly by students in terms of ‘interactive learning’, ‘collaborative learning’ and ‘a sense of learning community’. This demonstrates that students who participated in this study endorsed the use of Elluminate *Live* as an interactive virtual classroom and appreciated the alternative approach that supplemented the traditional learning approaches. The positive learning experiences of students with Elluminate *Live* are also noted as evidenced by their commendations on the recorded e-Review sessions and usefulness of e-Review materials.

However, there are also limitations to the robustness of these findings owing to the low number of participants as seen by the small sizes of student groups in the live e-Review sessions and those who chose to respond to the online survey. Accordingly, the results discussed herein should not be generalised but are better treated as a typical case study. Higher sampling data numbers have to be obtained and analysed in order to build confidence in the interpretation of the results presented here.

From student testimony, the expansion of the e-Review program to the Statics and Fluid Mechanics modules is recommended to yield a review mechanism for the complete unit that would benefit student-attainment of the unit's overall learning outcomes. To encourage student participation in such a teaching modality, it may be necessary to introduce this e-Review program as a formal unit activity, perhaps attracting participation marks, and an integrated mechanism for providing practical feedback and valuable advice to students; a similar strategy has been found necessary to ensure traditional tutorial attendance in the unit. An extension of present work is a follow-up of participating students to find out why they used the e-Review program and how their assessment marks were influenced as a result of the e-Review participation.

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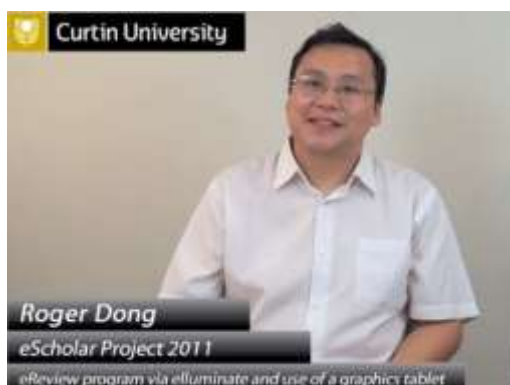
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[eScholar 2011 – Roger Dong – Case Study Video](http://youtu.be/HO6QwWrv0Gg)

<http://youtu.be/HO6QwWrv0Gg>

Electronic portfolios: Demonstrating student competence against external accreditation standards

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KEYWORDS

ePortfolio, portfolio,
evidence, accreditation

Abstract The aim of this eScholar project was to evaluate the effectiveness of an electronic portfolio as a learning and professional development resource for clinical-based health professionals; in the first instance its use by nursing students was explored. Portfolios have been used in nursing practice as a repository of evidence against nursing standards since the 1990s. Early portfolios were paper based, whilst recent iterations have evolved into electronic portfolio formats. An iPortfolio, available to all students studying at Curtin University, was integrated into the clinical practice units within the Bachelor of Science (Nursing) program as a suitable adjunct to support student learning and assessment. A cross-sectional study was conducted in 2010, involving a convenience sample of 115 students in the first semester of their course. A questionnaire solicited data on demographics, information technology skills, iPortfolio use, its structure and function and impact on the learning process. The information technology skills required for iPortfolio use were met by the majority of the study population, despite some having irregular access to computers and the Internet. Some onerous iPortfolio functionalities limited the full application of the tool for demonstrating professional-based competencies; however its value was recognised by users. Using the tool supported learning processes, particularly reflective practice, gaining feedback and self-determination of learning capacity. The results suggest the iPortfolio has potential as an electronic learning and assessment tool. With minimal modifications, its affordances support the demonstration of a skill set and evidence display against Curtin's graduate attributes and the Australian Nursing and Midwifery Council's competencies.

Background

Context

Portfolios have been used by health professionals for some years. Within the School of Nursing and Midwifery they have been used in clinical units in undergraduate and postgraduate courses. Currently nursing and midwifery students are required to meet standards of practice established by an external professional accreditation body, the Australian Nursing and Midwifery Council (ANMC) Competency Standards (2005). The

portfolio provides the means for students to capture and demonstrate their competence against these standards.

In the past, a paper-based portfolio was used for the assessment of students' professional competencies. However, in 2010 an eScholars Program grant was awarded to enable the application of an electronic portfolio (developed for the broader Curtin community) into the undergraduate nursing curriculum. The first phase of the study involved adaptation of the Curtin iPortfolio template to meet the needs of nursing; specifically the incorporation of the ANMC competency standards was warranted. By semester two 2010, the iPortfolio was ready to be pilot tested with nursing students enrolled in the undergraduate nursing programme. In particular, its use as an effective tool for showcasing clinical competency was tested.

The study involved all first semester Bachelor of Science (Nursing) students at Curtin Bentley campus, who were enrolled in the first clinical unit of their course. The iPortfolio development was structured as an assessment item for the unit, making up 30% of the assessment load. Completion of the questionnaire associated with the study was not an aspect of the assessment and non-participation in the study did not impact on the students' progress in the unit.

Rationale

The use of the iPortfolio in the nursing programme is important because recording evidence against national standard competencies is a requirement of all students enrolled in clinical units. Further, developing an appropriate electronic tool to facilitate competency measurement is a strategic direction of contemporary professional practice. Success in this area would be a significant achievement for Curtin's School of Nursing and Midwifery. Hence, the development of a user friendly, on-line space that supports student learning and acts as a repository for evidence against the national competency standards and Curtin's graduate attributes is a goal of the clinical, and teaching and learning directorates in the School. In addition, educational learning objects are advancing rapidly and electronic learning and teaching resources becoming commonplace. As such the iPortfolio complies with advances made in portfolio development and supports the trend for digital tools in education and learning. It was also hoped that the iPortfolio would be embedded across the students' whole of course clinical learning journey and thus the early establishment of its structure, format and effectiveness essential for the successful integration of the iPortfolio into the course. Further, it was also anticipated that the iPortfolio would be used as a prototype for other courses requiring competency testing, including clinically based postgraduate and midwifery courses as well as having application to other health disciplines.

Literature review

A literature search was conducted to underpin the project. It began with the consultation of a wide range of journals, books, previous research papers and Government

documents. Searches were made using the terms 'ePortfolio', 'electronic portfolio', 'electronic learning support', 'digital teaching approaches' and 'iPortfolio'. The term iPortfolio is a brand name for the electronic portfolio developed at Curtin. The review was informed by a consideration of literature about eLearning and the use of electronic support for teaching with literature considered for this proposal accessed via various databases that included, MEDLINE, ProQuest, CINAHL, EMBASE, Allied and Complementary Medicine (AMED), Your Journals @ Ovid and Journals @ Ovid Full Text. The date parameters in most cases represented the limits of the search facilities within the respective databases, although in some cases search limits were drawn in the early 2000s given the relatively recent nature of the data available. Some of the literature discovered was arrived at in a serendipitous fashion during random journal searches or from contacts with nursing/professional colleagues. No specific country was excluded from the search, although much of the literature originates from Australia, the United Kingdom, the United States of America and New Zealand.

There are a number of papers and book chapters that address the principles of electronic learning (Alexander & Boud, 2001; Bogossian, Kellett & Mason, 2009; Herrington, 2009; Kearney & Schuck, 2006). These consider the value of electronic resources for learning and advocate electronic learning modalities over more traditional approaches to learning. Most report on pilot projects and consider the use of a range of electronic resources (e.g., iPhones and palm devices) for student learning.

The increasing interest in ePortfolios in the higher education sector culminated in the Australian ePortfolio Project. This project specifically focused on the use of ePortfolios by Australian university students and incorporated as chief investigating agencies, the Queensland University of Technology, University of New England, University of Wollongong and University of Melbourne (Australian ePortfolio Project, 2008). The purpose of the project was to study the current levels of ePortfolio practice in Australian higher education. The findings suggest a high level of interest in ePortfolios and that a number of courses were using or considering the use of ePortfolios to support student reflection. The key recommendations of the project support the engagement of government policy, technical standards, academic policy and learning and teaching strategies to advance the ePortfolio as a cutting edge, pedagogically sound educational resource. Another recommendation of the project supported the need for further research to identify the benefits of ePortfolios in the teaching environment.

Several studies addressed the use of ePortfolios for the assessment of various health professionals including: pharmacy students (Lee, Kinsella, Oliver, von Konsky & Parsons, 2010), occupational therapy students (Tan Torres, 2004), medical and nursing students (Garrett & Jackson, 2006; Nash & Sacre, 2009), nurses (Andre, 2010; Naude & Moynihan, 2004), nurse practitioners (Anderson, Gardner, Ramsbotham & Tones, 2009) and students studying a range of health and other disciplines (Oliver, von Konsky, Jones, Ferns & Tucker, 2009). A key feature of ePortfolios lies in its potential to enable the

gathering of evidence against clinical competency standards or clinical practice / fieldwork learning experiences (Australian ePortfolio Project, 2008). Researchers have attested to the value of ePortfolio for gathering evidence of a student's clinical competence (Anderson et al., 2009; Andre, 2010; Cook, Walker, Creedy & Henderson, 2009, Curtise, White & McKay, 2007; Lee et al., 2010).

Two studies undertaken at Curtin University were particularly relevant to the present project. The first by Oliver et al. (2009) reported on the wider issues of iPortfolio development at Curtin. Specifically, it outlined the university's drive to foster an iPortfolio culture and focused on the links between an iPortfolio and Curtin's graduate attributes. The second study of note investigated the impact of the iPortfolio use within a pharmacology course (Lee et al., 2010). This study used convenience sampling to gather quantitative and qualitative data about the potential capabilities of the iPortfolio to support student engagement, learning and reflection. The results were promising; students confirmed they were able to use the iPortfolio for storage of learning material and benefited from its use as an assessment tool. However, weaknesses in its ease of use and capacity for customisation were identified.

The literature pertaining to ePortfolios is growing, however much remains to be investigated. Emerging evidence highlights the benefits of ePortfolios for a variety of learning and assessment purposes. Significantly, literature related to the development of Curtin's iPortfolio system is available and offers insight into research foci and questionnaire design, as well as providing preliminary accounts of the value of integrating iPortfolios into courses of study. Other related studies recommend further investigation to determine the value of electronic portfolio in teaching and learning support.

Research Purpose

The aim of the study was to provide preliminary data on the effectiveness of the iPortfolio as a learning and professional development resource for use by nursing students. Specifically the objectives were to:

1. Identify how students learnt to use the iPortfolio
2. Evaluate the structure and function of the iPortfolio
3. Determine the impact of the iPortfolio on students' learning processes.

Project Methodology

Methodology

A cross-sectional study conducted July to November, 2010 utilised survey methodology to assess iPortfolio users opinions. A convenience sample of pre-registration nursing students enrolled in a unit of study, specifically structured to incorporate the iPortfolio as a learning and assessment tool, were eligible to participate in the study. All students ($n = 115$) were invited to complete the survey; 80% ($n = 92$) responded. Ethical approval was granted by the University Human Research Ethics Committee.

Survey development was informed by a literature review, consultation with the information technology team at Curtin University who were responsible for designing the iPortfolio template and the Curtin based study of Lee et al. (2010). The survey comprised three parts. Section 1 focused on participants' characteristics, such as personal attributes as well as study status variables. Section 2 contained items to assess information technology (IT) related attributes including a four item self-confidence with information technology scale (Cronbach alpha = 0.93), regularity of use of IT (1 item) and access to technology for iPortfolio use (1 item). Section 3 contained items specific to the iPortfolio, including how students learnt to use it, its structure and function (Cronbach alpha = 0.81) and the impact its use had on their generalised learning processes (Cronbach alpha = 0.89) and learning processes that assisted their professional development (Cronbach alpha = 0.81). All items in Sections 2 and 3 were measured using a Likert scale of 1 "strongly disagree" to 4 "strongly agree".

Students were introduced to the iPortfolio in their first tutorial and each student was offered guidance about the process to access their iPortfolio site. Each subsequent tutorial was used to encourage students to develop their iPortfolio and several other opportunities were provided to assist students with the technology, these included: individual tutor instruction, a sample nursing related iPortfolio, group tutorial sessions, information on the unit Blackboard site, specific educational activities provided by the Learning Centre (a central student learning support agency within the university) and focused instructional lectures on iPortfolio use.

Surveys were completed immediately post iPortfolio use of 12 week duration and data analysed using the Statistical Package for the Social Sciences, version 17.0 (SPSS, 2008). Figure 1 summarises the research process used in this eScholar project.

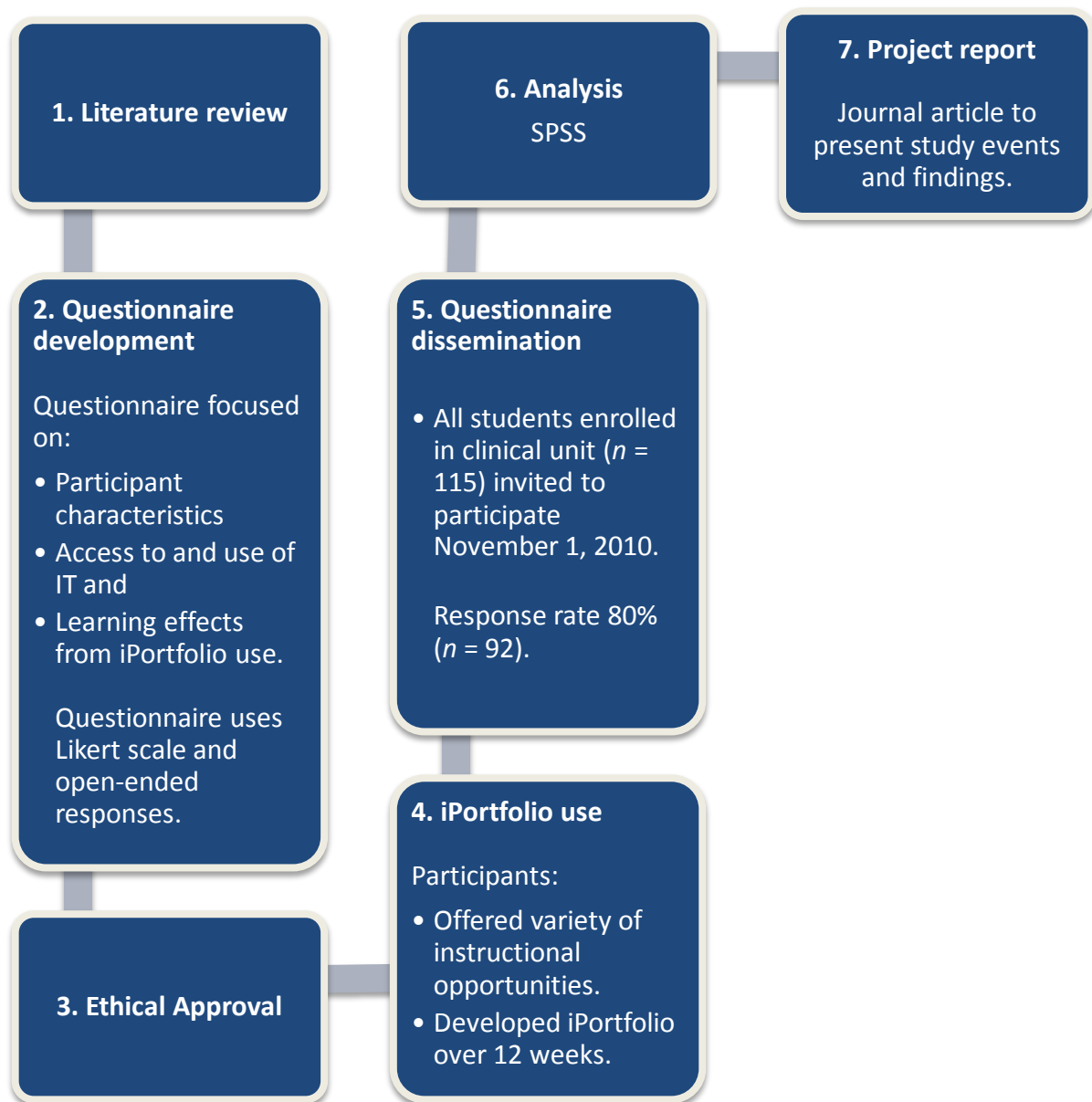


Figure 1: Research process summary. The study involved seven key phases, commencing with a literature review to inform the study and questionnaire and culminating in the final stage of project write up.

Findings

The 92 participants were primarily female (90.2%), average age 25 years ($SD = 8$), range 17 to 62 (see Table 1). The majority were domestic students (84.8%) and English was the primary language (70.7%). Most were fulltime students (88%) with almost 70% working whilst they studied.

Table 1: Participant characteristics

Participant factor		<i>n</i>	%
Gender (<i>n</i> = 92)	Female	83	90.2
	Male	9	9.8
Age (<i>n</i> = 89)	≤ 20 years	37	41.6
	21-40 years	46	51.7
	≥ 41 years	6	6.7
Primary language (<i>n</i> = 92)	English	65	70.7
	Asian	17	18.5
	African	6	6.5
	European	4	4.3
Residency location (<i>n</i> = 92)	Domestic	78	84.8
	International	14	15.2
Study status (<i>n</i> = 92)	Fulltime	81	88
	Part-time	11	12
Employment status (<i>n</i> = 91)	Fulltime	5	5.5
	Part-time	58	63.7
	Not in paid work	12	13.2
	Home duties	16	17.6

IT skills

Eighty eight per cent of participants rated their confidence to use information technology as adequate or higher ($M = 3.33$, $SD = .75$). In particular, 90.3% ($n = 83$) felt they had sufficient levels of IT skills and Internet skills, whilst 85.9% ($n = 83$) reported feeling confident using social networking programs. For most students (85.8%, $n = 79$) access to technology to run the iPortfolio was not problematic and more than three quarters (80.5%, $n = 74$) accessed the Internet regularly. However, as can be seen from Table 2, a small number of students considered their confidence and skills lacking, some were irregular users of the Internet and others encountered difficulties accessing the technology to use the iPortfolio.

Table 2: IT characteristics

IT factor	Positive <i>n</i> (%)	Negative <i>n</i> (%)
Confidence	81 (88)	11 (12)
Access to technology	79 (85.9)	13 (14.1)
Regular use of Internet	74 (80.5)	18 (19.5)

Learning to use the iPortfolio

Students learnt how to use the iPortfolio through different instructional strategies, although the most common was trial and error (80.4%, $n = 74$), followed by instruction available on the Curtin web site (69.6%, $n = 64$) and the unit Blackboard site (61.9%, $n = 57$), whilst less than half gained assistance from a university staff member (43.5%, $n = 40$) or a fellow student (42.4%, $n = 39$) and only a quarter accessed any Curtin specific iPortfolio course (27.2%, $n = 25$). Despite the use of various strategies, a third of students (33.7%, $n = 30$) indicated they were still unsure how to use the iPortfolio.

Structure and function

The structural and functional features of the iPortfolio were rated marginally above average ($M = 2.67$, $SD = .69$), suggesting its ease of use was problematic for some. As can be seen by Figure 2 the feature considered easiest to use was the ability to maintain privacy and security of evidence within the iPortfolio ($M = 3.00$, $SD = .59$), whilst the least favoured featured was the ability to tag evidence against the ANMC competencies ($M = 2.62$, $SD = .71$).

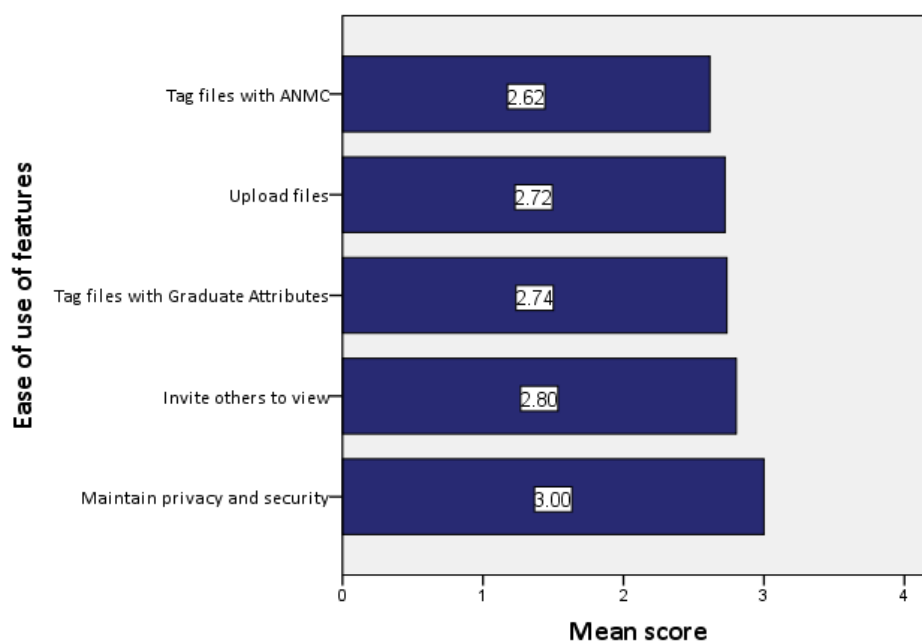


Figure 2: Structural and functional features of the iPortfolio, assessed using a Likert scale of 1 “strongly disagree” to 4 “strongly agree”.

Impact on student learning

The impact the iPortfolio had on learning was assessed from the perspective of learning processes and professional related learning. Figures 3 and 4 indicate the use of iPortfolio was favoured more for its value in supporting professional-related learning behaviours than those related to learning processes.

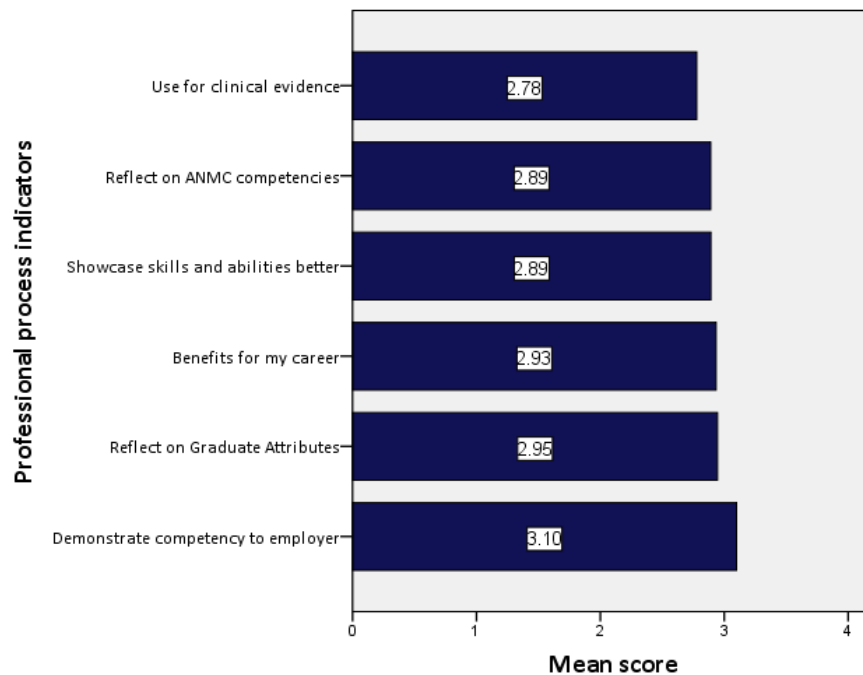


Figure 3: Impact of iPortfolio on student learning process, assessed using a Likert scale of 1 “strongly disagree” to 4 “strongly agree”.

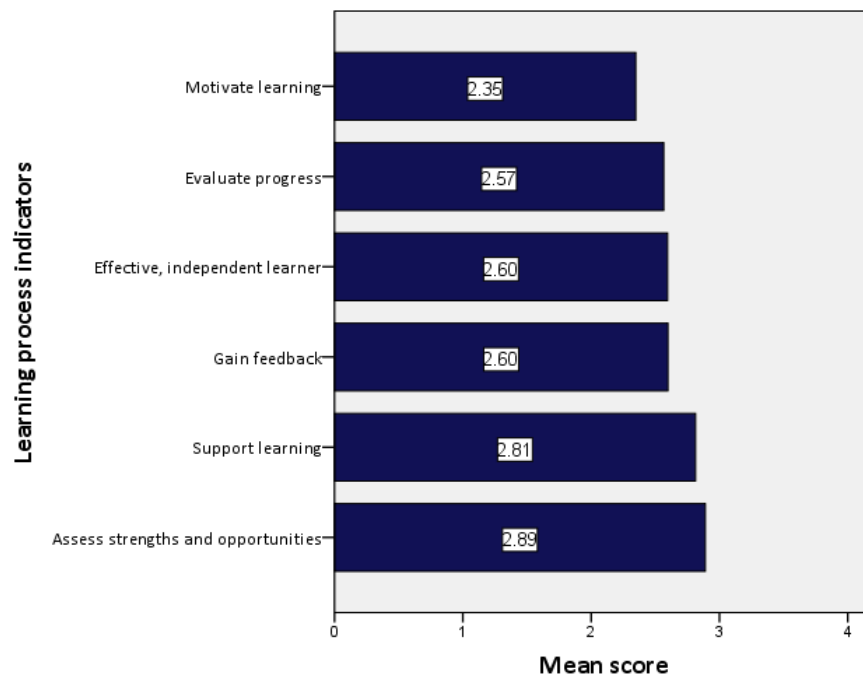


Figure 4: Impact of iPortfolio on professional related learning process, assessed using a Likert scale of 1 “strongly disagree” to 4 “strongly agree”.

Most students (75.8%, $n = 69$) were appreciative of the use of the iPortfolio as a tool to assist their learning and its ability to support self-assessment of strengths and weaknesses. In particular, more than half of the students felt it helped them to evaluate their progress in the unit and become an independent learner (55.4%, $n = 51$), and gain more feedback on their learning (58.7%, $n = 54$); whilst results showed a positive trend, over half of the students (58.7%, $n = 54$) felt the iPortfolio did not motivate them to learn.

With regards to professional-related learning, students rated the iPortfolio highly as an effective tool for the support of reflection on Curtin's graduate attributes (82.6%, $n = 76$) and the ANMC competencies (80.5%, $n = 74$), whilst approximately three quarters of the students indicated the iPortfolio was useful for showcasing their skills and abilities (77.1%, $n = 71$) and clinical evidence (70.6%, $n = 65$). In particular, 78.3% ($n = 72$) could see its application for career purposes.

Overall comments

Although some advantageous effects associated with the inclusion of the iPortfolio as a teaching and learning tool into a unit of study were apparent, there were mixed responses to the overall acceptance of its use. Over a third of the student cohort did not consider it a positive learning experience (39.1%, $n = 36$), finding the time spent to develop the iPortfolio was hard to manage (36.9%, $n = 34$), whilst 38% ($n = 35$) indicated a preference for a paper-based portfolio. Some of the factors that may have influenced less favourable opinions of the iPortfolio are shown in Figure 5. The most problematic aspect of the iPortfolio was its poor performance when uploading evidence against the ANMC and graduate attributes. Typically students commented it was "difficult when uploading documents other than pdfs", "difficult cutting and pasting from word" and "evidence didn't always appear, had to reload which took a lot of time." However, some students attributed the uploading problems to inaccessibility of a scanner, rather than problems with the functionality of the iPortfolio itself. Users reported finding the iPortfolio to be overly complex, finding it "very convoluted" and "not user friendly;" even going as far as stating that "it seems like very outdated technology."

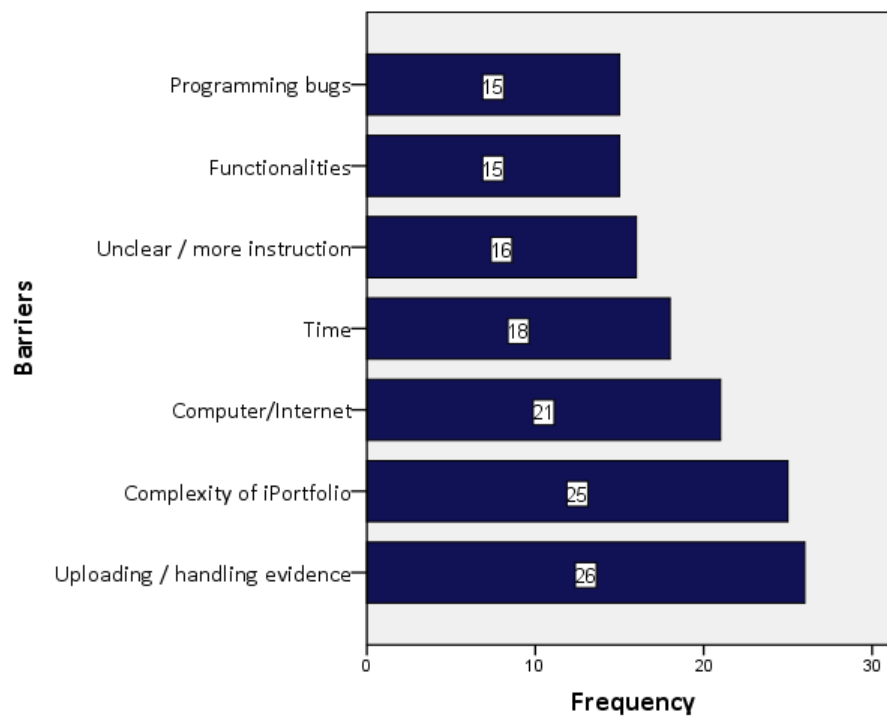


Figure 5: Barriers affecting the use of the iPortfolio as identified by users

Figure 6 illustrates four main categories of improvements to the iPortfolio suggested by student users. Given many students reported finding the system complex, it was not surprising to find that the primary need identified by users was the requirement for more classroom/laboratory preparation and a step by step guide to assist in its use.

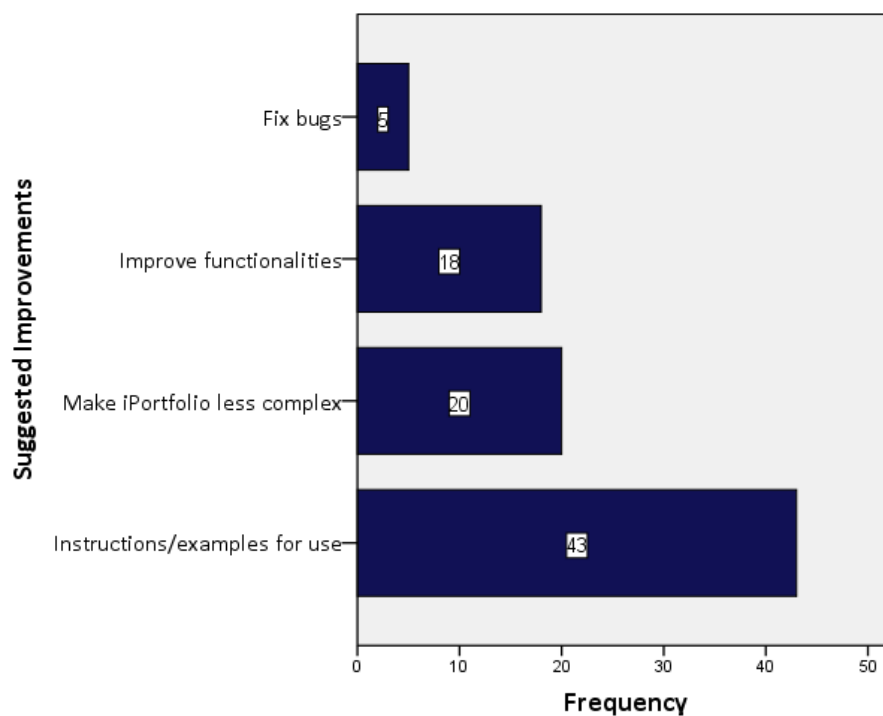


Figure 6: Suggested key improvements to the iPortfolio system identified by users

Conclusion

When considering what worked well, what could have been done differently and what implications this study has for the future of iPortfolio use at Curtin and especially the Curtin nursing program, the results offer a number of conclusions. It is clear that the use of an iPortfolio is at the neophyte stage of development in the nursing course and further investigation is warranted with current students in this study as they progress through their course, as well as new to course students who may benefit from what was learnt in this project.

IT skills

The study results demonstrated that the majority of students (88%) felt confident to use information technology, including computers and the Internet. This compares favourably with the findings from the study by Lee and colleagues (2010), which showed that 91% of students had “good” or “very good” IT skills. The mean age of study participants was 25, and given young adults are particularly conversant with computers and IT platforms this finding is not surprising. However, the integration of the iPortfolio platform in a course of study presents challenges for a small number of students who report being less confident in using computers and IT literacy; these may well be middle-aged students, international students, those with limited access to computers, related technology and the Internet. Qualitative responses confirmed the lack of access to a computer and/or the Internet operated as barriers to using the iPortfolio. Whilst students struggling with the computer or technology may be in the minority, nevertheless, if the iPortfolio is to remain a principal learning and assessment feature of the nursing course, this shortfall will need to be considered and further investigation is warranted to clarify the issue.

Learning to use the iPortfolio

Not all students knew intuitively how to use the iPortfolio format. Lee et al. (2010) found that initially 47% reported feeling uncertain, negative or anxious initially, but by the end of the semester only 5% felt the same. However, in the present study a third (33.7%) of the students indicated they were still unsure how to use the iPortfolio. Some of the reticence may be attributed to perceived deficiencies in the structural and functional configuration of the iPortfolio platform, discussed later, and/or inadequate levels of related-instructional support.

A number of strategies were available for students to gain understanding on how to use the iPortfolio. Of the unit specific strategies not all occurred as planned, for example, an instructional lecture was only able to be timetabled late in the semester and so proved less valuable than anticipated; whilst weekly tutorials focusing on the iPortfolio were hampered by IT issues in some tutorial rooms. Consequently, most students (80.4%) employed a trial and error approach to learn how to use the iPortfolio. Furthermore, given the newness of the iPortfolio tool the skill set of some tutors may have been less than adequate. The Joint Information Systems Committee (2008) stressed the importance

of investing in staff training and support if iPortfolios are to be effectively embedded in the curriculum. The Australian ePortfolio project has developed a user toolkit, which comprises a series of ePortfolio concept guides, including ones for students and staff. Staff opinions were not assessed formally in the eScholar project, although anecdotal evidence from staff indicates developing increased familiarity not only with setting up an iPortfolio but also how it operates within the unit is necessary. Further, the student users identified the need for step by step guides and greater classroom preparation. Curtise et al. (2007) indicate that web based support and instruction can be useful and in the eScholar project most students did employ supplementary web based resources accompanying the Curtin iPortfolio (69.6%) and unit Blackboard site (61.9%). In light of these findings, thinking still needs to be accorded towards optimising strategies designed towards facilitating students' understanding of the iPortfolio.

Structure and function

Despite participants reporting a degree of comfort when using computers, the Internet and other social networking programs the mean ratings related to the ease of the iPortfolio use were not as high, to the extent that some felt the platform was unnecessarily complex. This is consistent with evidence from the study undertaken by Lee et al. (2010) which used the Curtin iPortfolio tool, where it was found participants felt the iPortfolio could benefit from being made more user friendly.

Most respondents accepted that the iPortfolio was safe and secure ($M = 3.00$) and relatively easy to invite others to view ($M = 2.80$), less so was its ability to tag files against the graduate attributes ($M = 2.74$) and ANMC competency standards ($M = 2.62$). Moreover, uploading documents as evidence was more difficult than expected ($M = 2.72$). The uploading of documents is critical for demonstrating and assessing graduate attributes and employability skills required in externally accredited health professional courses. Andre (2009) saw the linking of evidence to professional standards as a key portfolio requirement and this was also one of the primary aims of Gardner's e-Portfolio (as cited in Anderson et al., 2009), where nurse practitioner students identified their competency standards as a key anchor for shaping their learning, developing reflection and understanding their scope of practice.

The uploading of evidence appears complicated by several factors; some technological issues and resource availability were noted. Students expressed frustration that the iPortfolio lacked basic copying and pasting capabilities common in Microsoft Office applications. Further, students reported that programming bugs in the system led to long delays in uploading evidence. The attachment of evidence was also more arduous for students who did not have ready access to scanners. The availability of such equipment in computing laboratories may be something that requires consideration at a school and university level if the portfolio can truly be used to display professional practice based evidence.

In particular, the linking of evidence to the ANMC competencies was not streamlined, despite it being a primary objective for the iPortfolio set up for this project. The lack of an established tab to the ANMC competencies on the iPortfolio tool complicated the processes involved in demonstrating how students meet an external set of criteria. This limitation is an issue not only for Nursing, but any other professional groups that are required to meet an external set of criteria. This may explain the high number of students who felt the time developing the iPortfolio was difficult to manage (36.9%) and they viewed the experience negatively (39.1%), which perhaps accounts for why more than a third of the participants (38%) preferred a paper-based portfolio. The negativity attached to the experience is in contrast to that found by Lee et al. (2010) where a larger number of students (83%) reported feeling enthusiastic and positive about the iPortfolio as a learning experience. However, the participants in this study were third year students and although artefacts were collected they were not required to be tagged against professional criteria. Accordingly, it is recommended that the tagging functionality of the software be considered further and the iPortfolio structure rectified in future versions of the tool.

Impact on student learning

The greatest perceived advantages of the iPortfolio were related principally to functionalities enhancing specific professional development and showcasing achievements to potential employers. The findings related to professional learning are consistent with others who recognise the value ePortfolios have in capturing information for potential employers (Anderson, 2009; Andre, 2009; Lee et al., 2010; Naude & Moynihan, 2004).

In particular, the iPortfolio supported reflective practice against both the ANMC competencies (80.5%) and graduate attributes (82.6%). Results pertaining to reflective practice are consistent with that reported in the Lee et al. study (2010), which also used the Curtin iPortfolio. The Australian ePortfolio Project (2009) considers reflection a constructivist practice that supports student engagement with learning and the advancement of lifelong learning abilities and argues ePortfolios are well placed to augment this skill.

It seems that despite difficulties encountered with uploading and tagging evidence against graduate attributes and ANMC competencies, the students saw the potential of the iPortfolio for professional performance. Students made a number of comments in this regard, suggesting for instance that it allowed them to, “create my study evidence which will be useful in the future” and “record study progress throughout the course.” It is worth noting that the study participants were new-to-course students and thus it could be assumed that as students progress through the course and continue to develop their iPortfolio the career benefits of the iPortfolio will become clearer. This aspect is worthy of further research.

The impact of the iPortfolio on learning processes trended favourably, although it was noticed that this was not as strong as its ability to support profession-specific learning. Participants reported that the iPortfolio allowed them to assess their strengths and opportunities ($M = 2.89$) and offered learning experiences to help them learn ($M = 2.81$). Central to this was the capacity of the iPortfolio to be shared with tutors and fellow students for feedback. Students commented that they liked receiving “encouragement from my tutor and fellow students” and “feedback and comments from other people.” In this regard the iPortfolio replicates features of other social networking sites. Students were able to invite their tutor or fellow students to see and to comment on any one page, or the whole iPortfolio. While the “My Ratings” tab allowed students to rate the quality of the evidence offered against various parts of other students’ iPortfolio. The ease of use for providing feedback also meant that marking the iPortfolio and returning comments to student was quick and simple and could be offered at any point during the course of the semester. The capacity of the iPortfolio to motivate learning was less pronounced ($M = 2.35$) and although a little higher, its impact on supporting students to evaluate their own learning ($M = 2.57$) and become independent in their learning ($M = 2.60$) was considered similarly disengaging. Furthermore, a quarter of the students reported the process of learning was not facilitated by the iPortfolio. These negativities may well be a reflection of some of the structural and functional features of the present iPortfolio format. In part, it may also be accounted for by the novice nature of participants; new-to-university students require considerably more directed learning than required in later parts of the course and based on the constructivist perspective, scaffolding and modelling is an important part of early learning processes. It would be interesting to repeat this study with students at later points in their course. Overall, despite some reservations surrounding its benefits, a large proportion of the respondents (75.8%) recognised the value of the iPortfolio as a learning and assessment tool.

Implications

There are implications for the development of the iPortfolio within the nursing programme at Curtin University, particularly the redesign of tutorial sessions offered early in the study programme to specifically address the students’ capacity to build and develop their iPortfolio. This could be facilitated in a computer laboratory and should be led by unit tutors who understand the iPortfolio and who are involved in iPortfolio development and assessment. There should also be a focused iPortfolio lecture offered early in the semester and wider access to iPortfolio development resources offered by the university.

Significantly, it is imperative for the success of the iPortfolio project that stronger linkages/tab facilities to the ANMC competencies are inbuilt into the iPortfolio. The iPortfolio’s capacity to support linkages between the ANMC competencies and the students’ learning and assessment activities, and clinical experiences sits at the heart of any portfolio and as such investigation to determine how the iPortfolio facilitates this is crucial. Determining the iPortfolio’s usefulness and value in the education of health

professionals is critical. Therefore, future studies should be planned to elicit the impact of the iPortfolio at different stages of the learning journey on a diverse range of health professional students.

In summary the iPortfolio as a tool provides an electronic repository for students to collect evidence against Curtin graduate attributes and the ANMC competencies. Whilst the latter proved more difficult for some students, at least the process of linking student activities, learning and evidence to the ANMC competencies was commenced. The value of the iPortfolio was recognised and allowed students to communicate with each other and with tutors about the quality of their evidence, learning processes and assessments within the units. Principally, difficulties in the iPortfolio use arose due to limitations in some of its functionalities and structural framework and these must be addressed with future iterations of the tool to maximise its value.

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[eScholar 2010 David Stanley - Case Study Video](http://youtu.be/GGHGuzBoqOk)

<http://youtu.be/GGHGuzBoqOk>

Students taking notes and creating summaries together (or not)

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KEYWORDS

Collaboration, cloud-based, annotation, unit summaries

Abstract Two collaborative elearning projects using cloud-based productivity tools were undertaken in a large first-year common-core business information systems and technology unit at an Australian university. The first project involved collaborative synchronous and asynchronous note taking and the second project involved collaborative synchronous and asynchronous summarising of unit materials. Enrolment was optional and very low (less than 3 per cent of approximately 600 students) and active participation even lower (even with considerable support provided). Results seem to indicate students need strong motivation to actively participate (especially when lurking can provide seemingly similar results). Students who did actively participate suggest active participation is probably more useful than the collaboration and somewhat resented students lurking. Collaborative elearning offers many rewards for students, teachers, and organisations, and the technology is available to facilitate this, even in very large classes, but it seems significantly harder to achieve than anticipated.

Background

Business Information Systems 100 (BIS100) is a very large first-year common-core unit (aka course) in the School of Information Systems at Curtin University, which introduces (mostly) business students to Information Systems, Information Technology, and Logistics and Supply Chain Management. We are keen to foster collaborative elearning amongst the students to increase student engagement, improve learning (particularly self-regulated learning), and reduce dependency on formal learning experiences and academic staff. In BIS100, we already use a range of technologies to facilitate, engage, and enhance student learning. The unit has been very well received by both on-campus students, who mostly attend lectures and workshops, and online students who do not (but can watch the video recordings of the lectures and workshops). BIS100 adopts a blended approach to learning, encouraging and requiring on campus students to use the online facilities (including online learning activities) as well as face-to-face sessions.

With the rise of web 2.0 productivity technologies, e.g. cloud-based services like Google Docs and Microsoft Live 365 that enable collaboration in productivity tools, two projects were envisioned where students could work collaboratively to 1) annotate lecture notes (in real-time during the lectures or afterwards) and, 2) create summaries of the unit content for test and exam preparation. It was thought that students could form an online learning community using such a collaborative tool. It was hypothesised that this could encourage students to be active learners who could interact with, but also create, learning resources. This would facilitate their learning and would also create artefacts useful as review aids for the semester test and final examination. The projects would also expose students to contemporary developments in technology, i.e. the use of cloud collaboration and annotation technologies, which would be relevant to their future employment. It was also considered that the project could investigate students' interest and aptitude for collaborative elearning in a higher education setting.

Literature review

Brown (2011, p. 50) suggests that Web 2.0 refers to “a range of software applications that have been variously described as ‘dynamic’, ‘interactive’, ‘democratic’, ‘people centric’, ‘volatile’, ‘social’, and ‘adaptive’, and as having more of a focus on “content creation than content consumption.” Although the use of Web 2.0 applications and approaches are becoming pervasive amongst students in their personal lives, a report into the impact on higher education of students' widespread use of Web 2.0 applications indicates that the use of Web 2.0 for learning is not generally a focus of students (CICLE, 2009). This is because for many students there is a clear demarcation of boundaries in ‘web space,’ e.g. personal space (messages), group space (social networking sites such as Facebook) and publishing space (blogs and social media sites such as YouTube). Using any of these spaces for the purpose of university study may be considered a violation of these boundaries for some students. This observation might explain why students may show discomfort with staff-initiated discussion groups in perceived social networking spaces, with students preferring to set up their own ‘web space’ for study-related purposes, or resorting to more conventional face-to-face methods for this purpose.

It is also apparent that many younger students are still seeking traditional pedagogical approaches in higher education, based upon their recent school experience (e.g., face-to-face contact). The CICLE Report (2009) concludes that this disjuncture between how students inhabit the ‘social web’ in their day-to-day lives and what they experience when they encounter higher education is because the higher education system at present is still traditional in its demeanour:

Characterised broadly, it is hierarchical, substantially introvert, guarded, careful, precise and measured. The two worlds are co-existing with present-day students occupying a position on the cusp of change. They aren't demanding different approaches; rather they are making such adaptations as are necessary for the time it takes to gain their qualifications. Effectively, they are managing a disjuncture,

and the situation is feeding the natural inertia of any established system. (CICLE, 2009, p. 9)

This indicates that students are both expecting, and familiar, with a higher education system that is ‘top-down’ in nature, in which students are encouraged to be consumers rather than creators of educational content. A study by Chang, Kennedy and Petrovic (2008) indicates that students may be reluctant to see the value in peer-created content because they may presuppose that academic-created content holds superior academic authority when compared to student-generated content, even when students perceive educational value in the processes of content creation. Whilst not universally rejecting peer-generated content, many of the students in their study struggled with such a shift in academic authority. Lippincott (2007) advocates that there is a need for higher education to prepare students to be content creators within their disciplinary or professional specialties. This could also provide a more meaningful way of encouraging the integration of a wide variety of skills into the curriculum, to assist with students’ future professional development.

There also appears to be a paucity of literature on student collaboration in elearning environments. Similarly, there appears to be little research undertaken into student use of student-generated resources within higher education. The latter, specifically, is a fertile area for investigation considering the increasing use amongst students (in other areas of their lives) of Web 2.0 social networking tools and platforms. These tools and platforms encourage collaboration and information sharing, if not artefact creation. It is an interesting question to consider whether students will eventually take up learning resource creation and perhaps, even, out do the academic staff in this regard.

The use of emerging technologies and tools to assist collaborative learning amongst students, such as social annotation (SA) tools, have not yet been extensively used and examined within the context of higher education. SA tools include online social bookmarking applications that allow annotating (adding comments, highlights, sticky notes, etc. to) electronic resources and support easy online information sharing. SA technologies also enable knowledge sharing solutions and are a platform for social interactions and discussions. Novak, Razzouk and Johnson (2012) conclude from their review of the literature that annotation technologies used in educational settings can increase participation and engagement; improve instruction; promote attention, communication and organisation; as well as improve reading comprehension and peer-critique skills.

Greater student engagement is one of the reasons for encouraging students to work collaboratively. Beer, Clark and Jones (2010) state that whilst there does not appear to be a single definition for student engagement, the definition offered by Coates that is an amalgamation of a number of distinct elements is useful; “Engagement is seen to comprise active and collaborative learning, participation in challenging academic

activities, formative communication with academic staff, involvement in enriching educational experiences, and feeling legitimated and supported by university learning communities” (Coates, 2007, p. 122). We propose that it is useful to regard ‘student engagement’ to include both activities that involve greater collaboration with other students undertaking the unit, and/or greater engagement with the learning content for the unit.

Steimle, Brdiczka and Muhlhauser (2009) indicate that university lectures are often considered as suboptimal learning settings for student engagement because communication is centred on the lecturer, causing learners to easily become rather passive listeners. Collaborative note taking and annotation activities are regarded as important elements to overcome this problem and encourage active learning and engagement (Prince, 2004 as cited in Steimle et al. 2009). Steimle et al. (2009) claim that the sharing of notes with other learners may encourage students to complete their notes, to critically examine their own understanding of the material, and to co-construct a shared understanding with other learners. In their field study of note taking amongst students in university courses, they found that most students do not use electronic tools for note taking and annotation, instead preferring pen and paper, again adopting traditional approaches. They describe a concept and system that enables students to collaboratively annotate lecture slides during a lecture, using a digital pen to make handwritten annotations on printed slides and empty pages, just like a traditional pen. They also found that although many students possess a laptop (78.6 per cent N=180), only a small number of students take notes on the device (19.6 per cent N=35). This is because many students find annotating lecture slides with a laptop distracting.

Neumann and Hood (2009) state that although there are many reports of the successful application of wikis in higher education, most of the claimed successes of wikis are not based on improvements in learning outcomes, but were related to the frequency of use of the system. Their study evaluated the use of a wiki to promote student engagement and learning of research report writing skills in a statistics unit. Students were divided into two groups - one group used the wiki to collaboratively write the practice report, whilst the second group wrote the practice report individually. Students who used the wiki to write the report gave higher ratings on cognitive engagement and engagement with other students. They conclude that wikis support collaboration among students and encourage more cognitive engagement with the subject matter. It was hypothesised that students working in a more collaborative way might be expected to show a better demonstration of learning outcomes on assessed work. However, it was observed that the marks obtained by students in both groups for a summative assessment did not differ significantly. They point out that the effects of using a wiki on student learning and engagement may be limited in the study due to the low participation rate, with further research needed to determine whether the learning benefits of working collaboratively are enhanced when there are higher levels of participation.

It is often assumed that most people are still consumers rather than creators of Web 2.0 content, generally speaking and with regards to learning in a higher education setting. It is currently also assumed that one per cent of people contribute content online, nine per cent edit it, and 90 per cent do not contribute at all (Nielsen 2006, Marwick 2006). Nov (2007) suggests that in order to understand what underlies user-generated content contribution (particularly in the context of Wikipedia), it is important to understand what motivates content contributors, and identify which motivations are associated with high or low levels of contribution.

Wangpipatwong (2009) states that although knowledge sharing has been gaining attention among researchers and business managers, with many studies examining the factors influencing knowledge sharing in an organisational context, little attention has been paid to addressing knowledge sharing among university students in a classroom environment. Within the context of educational institutions, Cho, Li and Su (2007) hypothesise that students may not share knowledge because they are afraid to lose their exclusiveness, and also see the knowledge they possess as their intellectual property, giving them a personal advantage. This assumption may be particularly relevant within the context of knowledge sharing in higher education (although higher education is not generally a zero sum game).

Olaru, Purchase and Letch (2010a) identified some of the factors that may cause students to be reluctant to participate in university online learning forums where there is a focus on sharing knowledge. They identified three behavioural clusters in online learning communities, based on a survey of students' values and online behaviours at the University of Western Australia.

The first behavioural cluster that they identified is known as the "reticent participants," (roughly 30 per cent of students surveyed), who tend to be younger and concerned primarily about the freedom to express conflicting views or being censored (Olaru et al., 2010b). They spend the least amount of time engaging in online discussions, and place less value on knowledge sharing and reciprocity. It is hypothesised that making this group of students' participation anonymous may encourage them as they will perceive less barriers (such as moderation) and will come to the realisation that participation will enhance their own learning and self-efficacy.

The second behavioural cluster identified by Olaru et al. (2010b) is the "individualistic contemplators" (roughly 39 per cent of students surveyed), of which 65 per cent were Asian students. These students value the relational aspects of online interaction (respect, prestige, and obligations), and are highly competitive. It is thought that if online learning forums provide more individual benefits or have built in activities to trigger participative behaviours this cluster may switch their current attitudes and intentions about online knowledge sharing. Anonymous online discussion boards may be one such example.

The third behavioural cluster Olaru et al. (2010b) identified is the "e-collaborators" (roughly 31 per cent of students surveyed) who tend to come from a significantly higher

age group and tend to be post-graduate students. These students are much more likely to share their knowledge within an online setting because they value the interactions within the network, are altruistic, and do not need recognition for their contribution. They are motivated to exchange ideas and expect reciprocity. Although “lurkers” (those that watch interactions but do not contribute content) come from the first two behavioural clusters, it is thought that in time, they will become e-collaborators too, but they need time to first settle into such online learning communities. Olaru et al. (2010a) also indicate that other issues affecting online participation include the degree to which students identify with their cohort, their shared language and interests, their collectivist and individualistic values, and their levels of nurturing behaviour. They conclude that all three clusters gain the most from university classes offering the opportunity to participate in both face-to-face and online methods of learning (i.e., blended learning).

Wei (2009) also testifies to the significance of national culture as being a major barrier to knowledge sharing. Language was seen to be the greatest barrier to knowledge sharing, followed by technical knowledge, concern for face, and technology infrastructure. Thongprasert’s (2008) investigation considered how cultural values affect the way Thai students (in both Thailand and Australia) access and share knowledge in a virtual classroom. They conclude that methods of knowledge sharing, communication and learning are profoundly influenced by the cultural values of students. As Thai students perceive a power distance between themselves and their lecturers, they are less comfortable to ask questions and present their ideas. Uncertainty avoidance is another factor, with Thai students in Australia tending to worry about losing face, and lack of language proficiency in online community discussions, instead preferring informal communication channels. This concurs with Ardichvili’s (2008) view that in Asian cultures, the desire to save face constitutes a significant barrier to participating in open knowledge sharing forums, where there is always a threat of ridicule. This observation may be a significant factor amongst the large number of international students enrolled in the BIS100.

Research objectives

The aims of this research were to:

1. *Get students to collaboratively annotate the lecture slides for BIS100.* A version of each week’s lecture and workshop slides were made available each week online in Google Docs native presentation format, for the students to collaboratively annotate the slides by putting their annotations in the “Speaker Notes”. Some students have been observed annotating their personal electronic (Microsoft PowerPoint) copy of the lecture and workshop slides in a similar way in class. Students would be somewhat familiar with this technology since they use Google Docs cloud service to do their assignment (writing and drawing) and share that with their Workshop Leader (and the Unit Coordinator) as a means of ‘submitting the work’ without having to print, email, or upload it. The Google

Docs presentation application works in a similar way to most other presentation applications.

2. *Get students to collaboratively produce learning unit summaries for BIS100.* Following on from (1) above, we also recommended that students construct their own summaries of each learning unit (i.e., primarily the lecture and workshop slides, and other learning resources), to facilitate their learning and as a review aid for the semester test and final examination. We decided not to provide summaries for the students, beyond a sample summary, but rather sought to motivate students to make the summaries themselves given the clear learning benefits that could result. No doubt a number of students already do this but the per centage is most likely very small. A template summary document for each learning unit was made available online within Google Docs. One of the templates was completed with the sample learning unit summary normally distributed to students.

We hypothesised that these activities would encourage greater student engagement both in terms of engaging with the unit content, and online engagement with each other when discussing their lecture slide annotations or learning unit summaries. We also hoped that it would encourage students to familiarise themselves with (and work towards achieving) the learning outcomes in a more incremental manner throughout the duration of the unit, rather than a last minute swot for the test and exam. We also anticipated, unfortunately, that getting students to participate in the projects, and be active contributors would be a significant challenge in itself, so planned to provide a considerable amount of support material for each initiative.

The research aimed to address the following questions to varying degrees:

1. Would the increasing use of Web 2.0 applications in students' day-to-day lives (e.g., Facebook, Wikipedia etc.), encourage students to collaborate in this manner in an instructor-designed collaborative elearning environment?
2. Would students be willing to actively participate in the project?
3. Which collaborative project would they prefer? Collaborative lecture note annotations or collaborative learning unit summaries?
4. Would Google Docs be an effective tool for them to use for these tasks?
5. Would the project encourage students to work more incrementally through the unit to achieve the learning outcomes?
6. Would they find other students contributions useful (and vice-versa)?
7. Would they find participation in the project beneficial to their overall learning?

Approach

This was action research. Trials were implemented in Semester 1 and again in Semester 2 of 2011. Introductory and support materials were developed, including a video to explain the purpose of each project, namely: 1) the Collaborative Lecture and workshop Notes

Annotation Project (CLNAP) and 2) the Collaborative Learning Unit Summaries Project (CLUSP). The collaborative services were configured and made available to students. Students were encouraged to participate in the project a number of times and through a number of channels (e.g., announcements made during lectures and workshops and via the Blackboard learning management system) at the start of the semester and a number of times during the semester. They were also informed that participation was voluntary, that they were able to withdraw at any time, and we were careful to point out that students' would not be assessed on their contributions, nor would they receive any points for participating.

To accommodate different learning styles a few different formats for the summaries were encouraged, e.g. a purely textual summary, a textual summary including a few simple diagrams, as well as a more visual summary like a mind map. These were not emphasised, however, because being mostly young first-year students their knowledge of, and ability to work with, other knowledge representations was generally assumed not to be strong. The annotation of lecture notes was primarily textual (i.e., the addition of 'speaker notes') but students could also annotate the slide content if they wished to and knew how to do this.

Attention was also given to how effective the projects would be if hundreds of students were trying to edit the same documents in Google Docs simultaneously. Google Docs does allow concurrent real-time editing by multiple authors (around 30 or so, depending upon which productivity application is being used), and the assumption was that not every student would embrace this task or undertake it at the same time within class or outside of class. Getting a substantial number of students to participate in the project, for this to be a problem would be an achievement in itself. Although Curtin University uses Microsoft Live 365 for student email and other services in the future (e.g., SkyDrive and Office Live 365), we concluded that as there were currently more severe limitations of concurrent authorship within Office Live 365, with no more than 10 students at a time being able to edit documents simultaneously, we would stick with Google Docs. Google Docs was also preferred because it provides embedded instant messaging tools that would enable students to discuss and reflect on the learning resources being created, whilst they undertook the collaborative learning activity.

Students enrolled in BIS100 (both on campus and online) during Semester 1 and Semester 2 of 2011, were invited to participate in the projects, which were introduced in the second week of the unit. In Semester 1, 2011 there were approximately 750 students enrolled on campus or via online learning, with additional students taking the unit through partner institutions. In Semester 2, 2011 there were approximately 600 students enrolled on campus or via online learning, in addition to students taking the unit through partner institutions. The student population is a diverse group; mostly students coming from high school, although there are some mature age students, and a large proportion of international students from various countries in Asia.

A survey was offered at the end of each semester to those students who chose to participate in either of the projects. The survey was implemented via Blackboard, and consisted of 12 items, with a combination of open-ended questions, Likert-scale questions, and multiple-choice questions. Basic data analysis was performed in Microsoft Excel. Ethics approval to conduct the surveys was granted by the Curtin University Ethics Committee.

Findings

Unfortunately, as mentioned above, there was a poor uptake of the projects amongst students across both semesters and both modes of study. Therefore the results detailed in this section are not statistically significant due to the small size of the sample. The CLUSP had a much greater uptake than the CLNAP across both semesters but participation was still very small (less than 3 per cent of approximately 600 students), which was disappointing considering the large numbers of students taking the unit. It is also important to note that BIS100 is a first year unit, and that perhaps a greater participation rate might have been achieved amongst students who had been in a university environment for a longer period of time (such as postgraduate students), who may be more confident and keen to participate in collaborative behaviours. As previously discussed, Olaru et al.'s (2010) description of 'e-collaborators' who are much more likely to share their knowledge in an online setting are students who come from a significantly higher age group and tend to be postgraduate students.

It was apparent that most students were not keen to participate in the projects, and of the few that did participate many did not wish to assist in annotating the lecture notes or creating the learning summaries, but just wanted to benefit from the work of an even smaller number of students. The low active involvement amongst those students who did participate in the projects matches the participation rates more generally found in online collaborative learning. As previously discussed, (Judd, Kennedy and Cropper 2010) document a very small minority creating content, a small number editing content, and the majority making no contribution at all.

Collaborative Lecture Unit Summaries Project

During Semester 1, 2011, despite a small number of students participating in the project (N=7) there was generally a high satisfaction rate amongst respondents, and all respondents wanting the trial extended to other units within the university. Students were clear about the objectives of the project (100%). Sixty per cent of students contributed towards the learning unit summaries, with 20 per cent of them contributing after the learning unit had been completed, and 40 per cent of them contributing in preparation for the semester test. Participants in the trial generally found other students contributions helpful (80%). Google Docs was seen to be useful for collaborative learning unit summaries by 80 per cent of respondents, and very easy-to-use (80%). Most students

used the summaries in preparation for the semester test (80%). Some positive comments from students participating in the project during Semester 1, 2011 included:

“Allowed for a greater expansion of ideas and a broader view of a topic otherwise seen from one angle. The collaboration also meant that we had a reason to review our work (and [study] notes) more effectively in order to portray our ideas in a more comprehensive style.”

“Being able to compile better quality and more rounded summaries, because of multiple contributing authors.”

During Semester 2, 2011, although there was a slightly higher number of students who signed up to the CLUSP trial (N=11), less students were clear about the aims of the project (45% of respondents), and 54 per cent of students made no contribution in terms of adding or editing content. Similarly, 45 per cent of students never looked at other students' contributions. There were lower satisfaction rates with the effectiveness of Google Docs for creating learning unit summaries, though this is perhaps explained by the observation that 36 per cent of students did not use Google Docs (because they had made no contribution throughout the semester). Fifty-four per cent of students did not use the CLUSP in preparation for the semester test. Fifty-four per cent of students were satisfied with the CLUSP, with the remainder either dissatisfied (9%), or not able to evaluate their satisfaction because they did not participate enough to comment (36%). Whilst 63 per cent of respondents would participate in CLUSP in the future, a higher percentage of students (72%) would like to see CLUSP extended to other units.

Some positive survey feedback from students included:

“It is great study tool, and it is also great to see what information other students find noteworthy. Occasionally I may miss something that another student picked up on.”

“I think it could be a great forum for discussion and lateral thinking in the unit.”

“Very good resource for revision and study for the final exam.”

“Would love to see this available for other units.”

“Great innovative idea! Don't stop this one!”

Collaborative Lecture Note Annotation Project

Only one student signed up to the CLNAP during Semester 1, 2011, and seven students participated during Semester 2, 2011. During Semester 2, 2011, amongst the small number of students that did participate in the CLNAP (N=7), many appeared to be unclear about the objectives of the project. This may be explained however, by the observation that 28 per cent of those surveyed did not read the documentation about the project at all, and 85 per cent did not watch the video that was provided. Some students commented that it was difficult for them to see when annotations had been added to the

slides in Google Docs. This is a valid point and technical limitation of most (if not all) presentation tools (i.e., it is not possible to simply and quickly tell which slides have new annotations in the speaker notes).

During Semester 2, 14 per cent of students completed the lecture slide annotations as they worked their way through the learning unit, and 14 per cent did the annotations in preparation for the semester test. Twenty-eight per cent of students were both satisfied with the CLNAP and likely to participate in a CLNAP in the future. Fifty-seven per cent of students wanted to see CLNAP extended to other units at Curtin University. Some positive responses from students included:

“Gives you the opportunity to work with other people.”

“A good thing about the Collaborative note taking would be that each student who contributes can learn off one another.”

“Anything involving collaboration is a good idea.”

“Viewing and learning from other students’ contributions (the few that actually DID contribute).”

Steimle et al.’s (2009) study of collaborative paper-based annotations of lecture slides, found that some students do not take notes because the course slides offered by the instructor contain sufficient information. This is most likely the case in BIS100 as well, where a great deal of effort has been put into developing very detailed and comprehensive lecture and workshop slides. In this regard, some students commented:

“The lecture slide and workshop explain very briefly, so I don’t have anything to add.”

“Most of my notes were repeating what is on the slide.”

“Lecture slides already sufficient.”

The issue of student anonymity was raised, with one student commenting: “I think it would have been more effective if it was anonymous.” Anonymity would be quite easy to achieve with Google Docs but, perhaps, a case can be made for encouraging students to share openly and worry less about perceptions of their contributions. Anonymity would, however, also make it easier to benefit from others without contributing themselves.

One student when asked why they did not add or edit any lecture or workshop slide notes commented that, *“nobody else had added notes.”* This statement is perhaps indicative of a more general state of apathy towards collaborative knowledge constructing behaviours, as well as the need for there to be a substantial number of individuals actively participating in order to make such a collaborative project viable.

Commonalities across both collaborative learning initiatives

There were similarities in the responses across both semesters within both the CLUSP and CLNAP initiatives, particularly in terms of the perceived barriers to participation. The small number of students who did contribute found the exercise of creating the learning summaries was perhaps more useful when done on their own rather than collaboratively. The possibility of potentially sharing annotations and summaries with hundreds of students was a disincentive, as was the lack of anonymity amongst students. This finding concurs with Olaru et al.'s (2010b) description of “reticent participants” in online learning, who tend to be younger students that prefer anonymity, like to express conflicting views, and do not like the possibility of their thoughts being censored.

As one student commented about the CLUSP:

“I joined the collaborative summaries later, after the semester test, but I found that it was easier for me to work from my own notes as I was able to arrange things in a way that would help me to remember and also to omit information that I already knew. I however think that they are a good idea and would have been very helpful to the majority of students.”

Other students commented that they felt they learnt best “from their own way of doing things” which inspired them to create their own summaries for each learning unit, whilst others felt that they had nothing else to contribute to other students’ summaries. Perhaps those who create their own notes could be encouraged to share and compare them with others doing similar (to find omissions and see different understandings and perspectives). One student commented that the CLUSP could be improved through “greater student uptake and participation.”

The problem of students ‘bludging off’ of other students’ contributions, whilst making no contribution to the project, was also raised:

“Although it sounds a bit jaded, I feel that a lot of students would simply ‘use’ the contributions of others instead of contributing also. As a high-achieving student, from my perspective it just feels like I’m doing work for others who can’t be bothered. That said, if it was secured so that only those who contribute could view them as well, perhaps that would be a bit more encouraging to use it? Probably feels more equitable that way.”

Again, the issue of ‘bludging’ was raised:

“Just felt that others could use it without contributing. It if it could be secured so that only those who contribute could view, I’d probably feel more comfortable as a high-achieving student who is often frustrated by the lack of effort shown by the bulk of students.”

“I didn’t participate because my notes are for me. It would irritate me if I took all the time to create those notes in a special way so that I myself could understand and if a bludger read straight off my hard work and didn’t create any of their own preparation. I would feel used and annoyed.”

One student gave a suggested solution to this problem:

“If a student has not contributed to the summaries at all a week prior to a test or exam, they should be removed from participating. If joined, it must be compulsory to make a contribution to the work.”

There was also feedback on how to increase participation in the project in the future:

“Small prizes for participating?! Though the benefits of the trial is a prize itself, until the collaborative trial becomes a mainstream uni practice, maybe an added incentive to get the idea off the ground would be good. If I did it again I’d do a summary as each week passes.”

Another student suggested:

“Keep the Unit Summaries project and remove the PowerPoint Note taking project. Using both might be effective, but is more efficient to stick to the one that provides the best results :-)”

Analysis

The success of these projects was stymied by a low participation rate amongst the whole student cohort who were invited to participate, and a low active involvement amongst those that did join the trials. Considering that this was research that aimed to increase collaborative behaviour amongst students, this was obviously quite problematic. This low rate of collaborative behaviour is consistent, however, with the observation that only a small number of individuals are motivated to engage in collaborative user-generated content production on the web at a more general level (i.e., outside of academia).

The literature review indicated that unless students are given specific incentives or rewards to participate, such a low response rate is not unusual. It is likely that the low participation rate amongst students is reflective of the behavioural cluster Olaru et al. (2010b) described as “individualistic contemplators”; they suggest these students are least likely to participate in online forums and need to see more evidence of individual benefits or require built in activities to trigger their participation behaviour. Sixty-five per cent of the individualistic contemplators cluster identified as Asian students in the study at UWA described as valuing the relational aspects of online interaction whilst remaining highly competitive may have similarities to this study group, given the large proportion of students from Asian countries enrolled in BIS100. This offers a possible reason why some students may not have felt motivated to participate in the projects. Further explanation is drawn from Ebner et al.’s research which revealed that of 287 university students engaging in a collaborative online learning activity, none created new articles or edited existing ones across an entire semester, when no rewards or incentives were offered for participation (as cited in Neumann & Hood, 2009).

It is also apparent from this study that students tend not to study and learn incrementally but mostly only in preparation for exams and assignment submission deadlines. Most students do not review and complete their notes or lecture slide annotations after the

class, but instead become more active when preparing for the semester test or the final examination. Amongst the students taking part in the trial in Semester 1, 2011, 20 per cent did the learning unit summaries after they had moved on to later learning units, and 40 per cent did them in preparation for the semester test (i.e., just in time). Again, this makes increasing collaborative behaviour amongst the student community throughout the semester more difficult. Perhaps students need to be taught collaborative behaviours (and made aware of the benefits) as much as anything else.

Low collaborative behaviour by students is also identified in Judd, Kennedy and Cropper's (2010) research that assessed students collaborative behaviour based on their contributions to a wiki-based shared writing task. Despite efforts to provide a learning design to support collaboration, a relatively small proportion of students did the majority of the work, and many students' contributions were considered superficial. Because the majority of contributions were made on the last day students could contribute to the wiki, there was very little ongoing collaboration. They conclude that wikis are not inherently collaborative and that additional components may be required to promote participation and collaboration amongst students. Thus, even when students are required to engage in collaborative behaviours because an assignment requires this, they still tend to leave contributing until the last minute.

Perhaps this apparent lack of enthusiasm to participate in collaborative behaviours with peers is because students do not value such collaboration. This may relate back to the observation that despite being immersed in a Web 2.0 environment, when it comes to the delivery of education most students still want a more 'traditional' experience and may be reluctant to use current technologies also. There is still a tendency for students to prefer face-to-face instructor led learning (but not lectures), which may have more perceived value to students than peer-generated content. There is still also a preference not to use technology when annotating lecture notes, with one student commenting, *"I prefer writing notes from lectures by hand."* This finding concurs with Steimle et al.'s (2009) observation that despite many students possessing laptops, most prefer not to use electronic tools for note taking in lectures because they see it as a distraction (to themselves and possibly other students). This may, however, change going forward with the popularity of more convenient tablets.

Another explanation may relate back to the notion of boundaries in 'web space.' Perhaps some students are more keen to engage in online collaborative behaviours in their private lives (through Facebook etc.), but are not ready or willing to make the jump to collaborating online in that way in an online learning context. This relates back to Olaru et al.'s (2010a) discussion of behavioural clusters in online learning. If anonymity were offered, this might appeal to some students. That said, one might also even question whether social media is really a form of collaboration (i.e., something like directed group work).

With regards to the research questions we can say:

1. The vast majority of the BIS100 student cohort, across both semesters, was not keen to participate in the two projects. This corresponds with the findings of other research studies, and the low levels of people who engage in user-generated content in other collaborative environments outside of academia (e.g., Wikipedia).
2. Amongst the very small number of students who did participate in the projects, an even smaller number were actively involved and contributing content. Most did not annotate slides or contribute learning unit summaries in an incremental fashion as they progressed through the unit, instead tending to do this in preparation for the semester test. Obviously this type of activity does not enable collaborative behaviour amongst the group.

As mentioned, for some of the students who signed up to the projects, the lack of anonymity was a problem. For others who were keen to contribute content there were concerns that the 'bludgers,' who were not actively contributing or editing content, would unfairly benefit from their hard work. As one student commented: *"If a student has not contributed to the summaries at all a week prior to a test or exam they should be removed from participating. If joined, it must be compulsory to make a contribution to the work."*

3. The CLNAP was not popular, particularly during the initial implementation of the project in Semester 1, 2011, when only one student signed up. A few more students signed up in Semester 2, 2011 but were not very active. The CLUSP was more popular, with some students suggesting removing the lecture slide annotation component of the project altogether, and extending the CLUSP to other units within the University.
4. There was an overwhelmingly positive response from students to using Google Docs for such collaborative behaviour. Students reported that it was easy to use and useful for the task.
5. Unfortunately, the projects did not encourage students to work more incrementally through the unit. There was still a tendency for students to contribute after the learning unit had been completed, or in preparation for the final examination. To be clear though, there was no real incentive in either project to encourage incremental learning (beyond the fact that they could immediately see other students' contributions).
6. Some students found their peers contributions useful, whilst others were unable to comment because they had never looked at the contributions made, nor made a contribution. One would imagine that if peer-generated content was more highly valued by students that this would lead to more students finding one another's contributions useful to their learning.
7. With regards to the CLNAP, students reported that they could learn from one another's contributions. They also liked the pre-designed templates, enabling them to go through each objective and summarise their notes into a document. One student also commented:

"I found the collaborative note summaries a good motivator for me to summarise my notes, re-read everything and make a good set of study materials for the examinations. I feel it would have been a lot more beneficial and enjoyable if more students joined in with the note making, and to discuss the material with fellow students. It would have made learning a lot easier and more insightful to gain the opinions and views from fellow peers. It was a shame not many helped to contribute. I was slightly disappointed with my fellow BIS100 peers. I am however extremely grateful to the two other students who did make contributions, and I hope they went well in their studies and exams."

Conclusion

The Collaborative Learning Unit Summaries Project got a better response from students, than the Collaborative Lecture Note Annotation Project, both in terms of the number of students signing up and the level of participation during the trials. The students who participated were also positive about the use of Google Docs for collaboratively sharing knowledge. It would have been beneficial to conduct either follow-up interviews and/or a focus group with students who agreed to participate in the trials, whether they were active or inactive content contributors. However, the small sample size and time limitations prohibited this. It would have also been interesting to survey students who did not participate to see why they did not participate.

For students not familiar with working in a collaborative user-generated content environment such as Wikipedia, it would have been useful to explain the principles and benefits behind this. As Wheeler, Yeomans and Wheeler (2008) indicate in their trial of a student wiki project, and as done in this project, students need to be informed about the probability of their work being edited or extended by others, or even deleted if other users consider their contributions inaccurate or inappropriate. Wheeler et al. also point out that it is important to raise the issue of authorship in such an environment, whereupon the ideas contained with the Wiki become part of the whole learning community. This point could have been better communicated in this research.

The most crucial issue affecting the success of future implementations of these projects would be to increase the participation rate of students; both in terms of signing up to join the projects, and then subsequently actively participating. Perhaps running only one of the collaborative projects at a time might be beneficial (as suggested by some survey respondents), such as the CLUSP that appeared to be more popular with students. One possibility would be to make participating in the collaborative project part of the unit coursework. However, as others have pointed out (e. g., Judd et al., 2010), although this does increase the number of students who are part of the trial, it does not necessarily increase the rate and quality of collaborative behaviour, with the majority of students adding or editing content the day before the coursework is due. The issue of giving students an incentive to participate was raised by a couple of survey respondents. Attention would need to be given to what form this would take, and considering that the motivations for participating in the projects would be quite diverse amongst the student population, perhaps a number of different strategies would need to be considered.

Generally though, students need to see that the main benefit would be that it could really assist them in the achievement of the learning outcomes for the unit.

The above issues are relevant to the subject of motivation. So perhaps it would be insightful to survey students on what encourages individuals to engage in content contribution. Nov's (2007) research in this area would be one example, where a volunteering motivation scale was used in accordance with a survey on contribution levels amongst a sample of individuals who contribute to Wikipedia. Likewise, it would be helpful to survey students about their volunteering behaviours more generally, and use of collaborative social media outside of the learning space. Several students who were keen to contribute content expressed their dissatisfaction with students who were 'bludgers' that could benefit from others work without actively contributing. The suggestion was that these students should either be removed from the trial altogether if they had not made any contribution by the week before the final exam, or should be forced to contribute content. This raises the issue of what would be deemed by students as an appropriate contribution, who would judge that, and what effect this would have on participation rates. In terms of examining some of the factors that may cause students to be reluctant to contribute, it would be helpful to survey students about their cultural background, whether domestic or international students etc. This may throw some light onto the possible cultural factors that may be at work, as indicated in Olaru et al.'s (2010) research.

As indicated above, this is a fertile area for future research investigations. It would be beneficial to address in greater depth how enhancing collaboration amongst students could lead to increased levels of student engagement, both in terms of contact with peers and also unit content, and hopefully then student learning outcomes. It would also be interesting to look at the extent to which students perceive the higher education sector as role-modelling good practice in terms of collaborative content creating and sharing behaviours. As previously discussed, the learning environments that students encounter in modern universities has barely changed over hundreds of years, so it is not therefore surprising that students still might prefer more traditional approaches. Perhaps students might be both more motivated and see more value in collaborative content creation, when such a project is seen to be part of a wider institutional commitment to 'open' and collaborative knowledge sharing practices amongst both staff and students. As Atenas (2011) states, within academia there is frequently a reluctance amongst staff to share teaching resources amongst staff even within institutions, requiring a wider cultural change to encourage a system of open knowledge practices, both in terms of using open educational resources (teaching and learning materials made available for reuse under an open license), 'open research' approaches, and open access journals.

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[eScholar 2011 – Ashley Aitken – Case Study Video](http://youtu.be/YlvIjieYdBI)

<http://youtu.be/YlvIjieYdBI>

Using knowledge networks to teach online writing skills in the professional writing classroom

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KEYWORDS

Knowledge networks,
online writing,
collaborative learning,
authentic assessment

Abstract Recent research shows that online knowledge networks can be effective learning tools. The aim of this project was to determine the value of knowledge networking in classes where students have minimal experience (and low confidence) in online environments; and where the web is both the learning environment and the object of their learning. In Writing and Research for Professional Contexts 311, students learn to research, write, and edit web-based material in preparation for the workplace. This project introduced and evaluated three new assessment tasks that exploited knowledge networking in developing student skills in online writing genres.

Background

The Professional Writing and Publishing (PWP) major in the Bachelor of Arts degree is designed to develop the next generation of professional communicators working in government, non-government or corporate environments. A fusion of creative writing and professional communication, this major produces job-ready graduates for careers such as feature writing, editing, corporate communications, speech writing, website writing, and public relations.

The growth of web 2.0 technologies has brought an increasing demand for graduates with online writing and editing skills (see Robertson and Scolaro 2011). We have responded to this demand by adapting our curriculum, learning, and assessment tools and methodologies to include a greater focus on online research, writing, and editing, and on the skills required to be an effective communicator in an environment where social media are becoming some of the most dominant communication strategies.

Participation in the 2011 eScholar initiative allowed us to trial a number of new learning and assessment tools in several of our units: for example, creating short video-podcast learning materials for Writing, Editing and Publishing 211; moving to assessed blogs in Writing Creative Non-Fiction 310; and creating an online community of fieldwork students in Professional Writing Placement 321. This chapter analyses the introduction of

new learning and assessments tasks in Writing and Research for Professional Contexts 311, a key third-year unit that prepares students for professional writing in the workplace.

The challenge

The Learning Outcomes for Writing and Research for Professional Contexts 311 are:

- Interpret and apply concepts and techniques necessary to a range of workplace writing and research tasks;
- Develop and evaluate a body of work in readiness for the diverse needs of professional practice in the workplace;
- Apply independent and collaborative workplace-specific writing skills to the management and resolution of a range of policy and professional practice issues.

In the past, students in this unit have written and edited briefing notes, reports, newsletter articles, and other print-based documents. In response to a rapidly changing workplace, however, we wanted students to develop the additional skills needed to write and edit websites and online text. Since many of them were unfamiliar with online writing, and had never created a website or done any formal internet studies, our challenge was to create learning and assessment tasks which provided effective, relevant training in online writing and editing, and which were manageable for students without any relevant experience. It was important that we did not try to teach website design, for example, as this is not our area of expertise and would not help our students achieve the learning outcomes for this unit.

A key component of Writing and Research for Professional Contexts 311 is team-based learning and assessment. Students work in small groups throughout the semester, pooling their research to complete a series of individual and collaborative assessments. In the past, the only collaborative assessment tasks were group presentations. However, new technologies have made collaborative writing and editing tasks much more readily available and easy to assess. In most workplaces, the research, writing and editing tasks are shared within small teams and we wanted to simulate this type of activity in this unit.

Approach

Our approach was informed by Matthew Allen's research findings on the use of knowledge networking techniques in the Internet Communications program and elsewhere (see Allen 2010 and 2012 and Allen and Long 2009). In this approach, online knowledge networking is not designed to take the place of face-to-face learning, but to be incorporated into the course structure to provide students with new and exciting opportunities for collaborative learning. Our aim was to develop effective learning/teaching and assessment tools for Writing and Research for Professional Contexts 311 using web 2.0 technologies that allow teachers to step back from the scene of learning, giving students room to work and learn with each other from their collective

skills set. We would intervene only when we can be really effective: when the students themselves realise what they need to learn, and what they can't learn from each other.

Based on the relevant teaching and learning literature (Allen 2012, Bloxham and Boyd 2007, Herrington and Herrington 2006, Woo et al 2007), our approach focused on:

- encouraging problem-based learning;
- creating a reflective and skills-sharing learning environment;
- creating a simulated real world environment; and
- building new learning tasks around assessment components.

New learning and assessment tasks

Three new assessment tasks were introduced. In the first assessment, students research and write a news article for a specific website (where previously their task had been to write a print newsletter item). Second, small teams share research documents using Google docs in order to jointly use this research as the basis for all written tasks in the unit. The unit coordinator is also a part of each small Google group. Finally, the teams write and edit a collaborative website for a specific purpose and audience as nominated by the unit coordinator and using a template provided on Google sites by the unit coordinator.

Although our aim is to develop independent thinkers and learners who will have the confidence to build their own mutually supportive learning networks inside their workplaces, these are all structured, scaffolded, and resourced assignments. Students are given an information sheet and an in-class demonstration on using Google docs and Google sites, including the vital information on controlling their own privacy settings and on allowing access to their websites only to group members and the assessor. They are provided with a Google sites template specifically designed for this assignment. We bring in a guest lecturer from industry to talk to them about real-world online writing. Students are shown examples of websites to analyse and evaluate, using skills they have learned in a lecture and seminar on internet-based research and techniques for assessing the credibility of online material. Lastly, individuals or groups have the opportunity to meet with the unit coordinator for assistance at any time if required.

The success of the new learning and assessment tasks was evaluated by two measures: the benchmarking of student-produced websites against industry-standard websites (by the unit coordinator); and feedback from students themselves—their opinions and beliefs about their baseline skills and what they learned in this exercise, collected through an Ethics-approved anonymous survey administered in week one and again in week fourteen.

Findings

Student products

While the work produced for the new assessment tasks varied in quality, the majority of it was judged by the unit coordinator to reach a base-level industry standard: that is, they were equivalent to what would be expected from new graduates. For example, one group was given the task of creating a website on behalf of a peak body for Western Australian writers. Its brief was to outline the challenges and opportunities that digital publishing offers to emerging writers. The website that this group produced was well structured, well researched, included relevant information and links in appropriate language, and was easy to navigate. It was, in fact, superior to the actual website produced by the peak body in WA.

It was significant that the students produced better work in their collaborative website than they did, overall, in their individual web news articles. A number of factors may have led to this of course including the greater time most students gave to the website task and the fact that the website task more closely simulated a real workplace task. Yet the findings appear to support the hypothesis that it is worthwhile to give students room to work and learn with each other from their collective skills set. Working in a collaborative team, their collective skills are greater than the sum of their individual skills. Knowledge networks are highly effective in teaching web-writing skills in the professional writing classroom.

Student opinions and beliefs

Students were surveyed at the start and the end of this unit in class time. The survey was optional and anonymous. While all 42 students completed the initial survey, only 36 completed the final survey, as a number of students missed the final class and did not take the opportunity to complete the survey afterwards when invited to do so in their own time. This may limit the extent to which the survey data can be generalised. The usual Curtin eVALUate report provided supplementary information and was completed by 16 students.

Previous experience

Only 11 of the 42 students (26%) in the unit had previously written text for both a website and a blog. Nineteen (or 45%) had written website text before and the same number had written a blog before (see Figure 1).

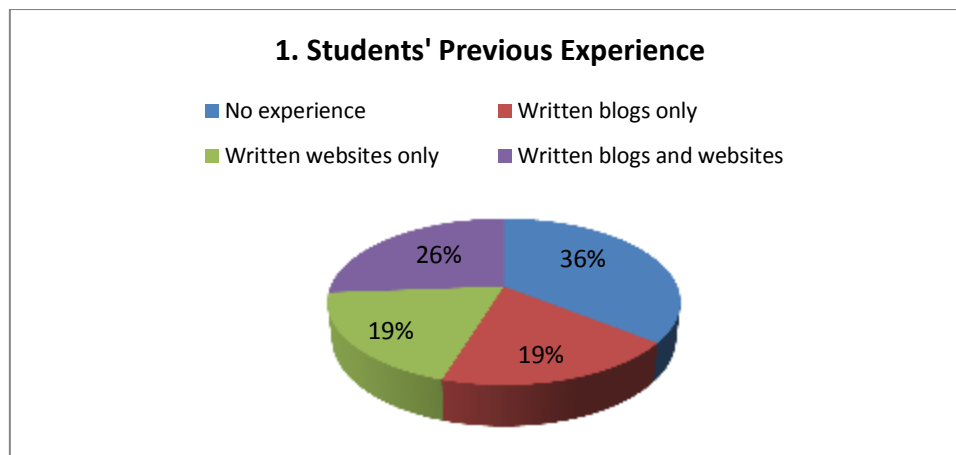


Figure 1: Students' previous experience

Confidence

Students were asked how confident they felt on a scale of 1 to 6 about their skills in research, writing, editing and working in a team on material for websites, online material generally, and print material. The same questions were then asked again at the end of the unit and a comparison made.

At the start of the unit, students were most confident in their skills in writing and editing print material (average rating 4.24) and working in a team to develop website material (3.76). By the end of the unit, students rated their skills in these two areas as 4.83 and 4.81 respectively, demonstrating a 14% increase in their average confidence levels at writing and editing print material and a 28% increase in their average confidence levels at working in a team to develop website material.

Those skills that students rated lower initially showed a greater increase in confidence by the end of the unit. For example, students initially rated their skills in designing the layout of a website at an average of 2.24 which rose by 64% to 3.67, even though the unit did not specifically teach website layout or design. Students initially rated their skills in writing new material for a corporate website at 3.31 and in writing material for a corporate blog at 3.29. These increased by 37% to 4.53 for writing website material and by 38% to 4.53 for writing blog text. The other skills addressed (research skills, editing skills, overall online writing and editing skills) rose by between 30 and 32% (see Figure 2).

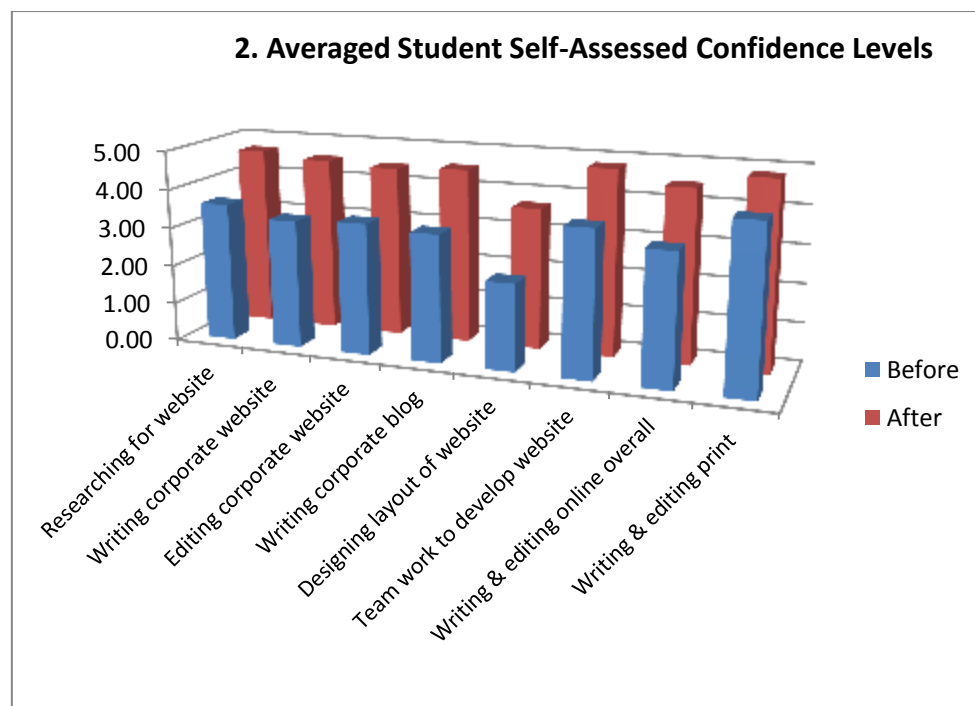


Figure 2: Average student self-assessed confidence levels

Value of learning and assessment tasks

At the end of the unit, students were asked to rate on a scale of 1 to 6 the usefulness of the range of learning and assessment tasks, guest lectures, tutorial input and feedback on assessments given (see Figure 3). Averaging these responses, all aspects were rated quite useful (3 or 4) or very useful (5 or 6). The most useful aspects were considered to be the unit coordinator's lectures and tutorial input (5.17), the assessment task of writing a collection of individually authored documents including the new online news article (5.08), and the unit coordinator's feedback on written work (5.00). The least useful activity was the use of Google docs to share research (3.89).

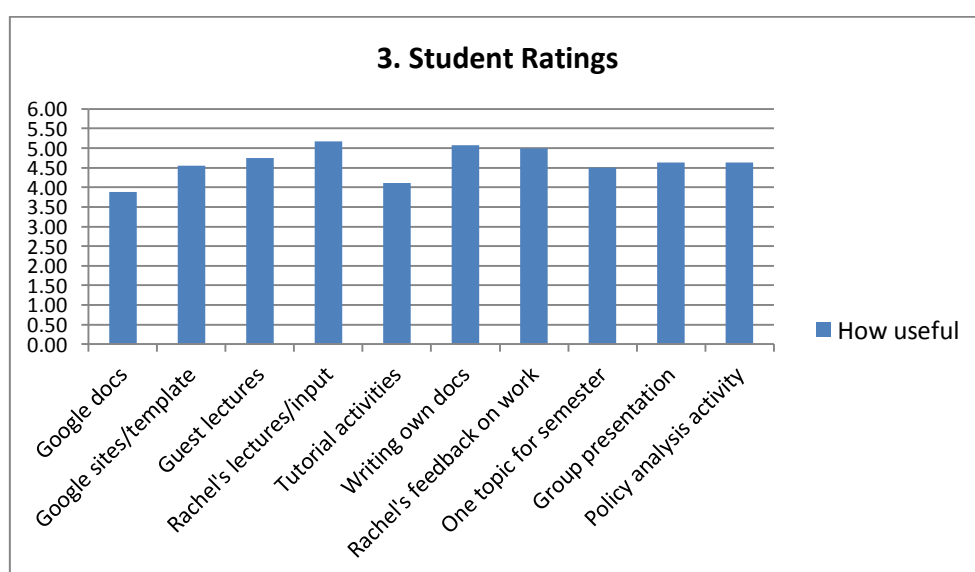


Figure 3: Student ratings of the learning tasks

Students were also invited to add any other comments to the survey form and many respondents did so. In general, the comments reflected a view that using Google docs was not as successful as the other aspects of the unit. The use of Google sites, however, and the specially created template was considered to be a valuable learning tool. Students found it hard but rewarding to work in teams to create a website, but many thought that also having to do a group presentation on the website was unnecessary. Comments made by students through the eVALUate survey were similar in content.

Among the most salient comments were:

- How to improve unit – ‘not so much in-class group activities; no Google docs’.
- How to improve unit – ‘have some classes in computer lab’.
- How to improve unit – ‘give more information about places to obtain research from’.
- Most useful – ‘learning to write in the appropriate manner to target the reader’.
- Most useful – ‘how to use Google sites’.
- Most useful – ‘confidence, I’m more prepared to enter the workplace with additional skills’.
- Most useful – ‘the access to such a wide variety of different texts (self-produced) in such a short time gave huge expansion to personal development as a professional writer’.
- Least useful – ‘Google docs – hard to use and not compatible with everyone’.
- Least useful – ‘sharing research for the individual assignment with Google docs took up more time than it benefited’.
- Other comments – ‘a very interesting unit, I’ve learned skills I know I will use in the future’.
- Other comments – ‘you run a very useful unit, the feedback you give on assignments is fantastic’.
- Other comments – ‘I wish all Professional Writing units were this relevant to careers and actually writing in the workforce.’

On the basis of these responses it is reasonable to conclude that the assessments were considered to be valuable and effective, although there is obviously a case for refining and streamlining some of the assessment technologies. These comments need to be evaluated in the light of the other findings, however. We agree that we need a more user-friendly document sharing platform as an alternative to the somewhat unwieldy Google docs; but once this is sorted out, the benefits of sharing research through an appropriate technology should become clear to students.

Conclusion

Are online knowledge networks effective learning tools for students who have minimal experience (and low confidence) in online environments, and for whom the web is both a learning environment and the object of their learning?

Our findings suggest that third-year PWP students (in 2011) had minimal experience in researching, writing and editing online material and that the changes to this unit provided them with a valuable opportunity to develop and apply the required skills and knowledge.

Students struggled with the use of Google docs as a tool for sharing research, in spite of the information and demonstration provided to them. The use of Google sites, however, proved successful and students produced collaborative work of a high standard. The task of writing individually-authored online news articles was less engaging to students than the task of collaboratively writing a website. The website task, as well as requiring joint problem-solving and reflection, was considered by students to be a more effective simulation of a real workplace task. While some students found team work to be difficult, most recognised the value of extending their team work skills and appreciated the opportunity to do so in an environment where the unit coordinator could support them and also view their individual contributions (as enabled by Google docs and Google sites).

Students undertaking Writing and Research for Professional Contexts in 2012 will have slightly more experience of online writing because they will have written blog posts in their first and second year units and may have participated in editing tasks through small group wikis. This unit, however, is still likely to be a key unit for developing online writing and editing skills, along with the new Advanced Editing and Publishing 322 (beginning in semester 2, 2012). The 2012 learning and assessment tasks have been refined based on the research undertaken. Students are given a number of choices about how they share their research now, including Google docs, Blackboard Groups, emailing each other and photocopying print material. The collaborative website task has been retained and students will have the opportunity to share their websites with other students in their class (though presentation skills will no longer be assessed, thus increasing the focus on the collaboration and the website text). The online news article assessment has been retained but the focus will be more specific, increasing its similarity to a workplace task. Finally, an additional lecture from an industry leader has been added on the uses of social media. We envisage continuing to adapt our learning and assessment tasks to provide students with opportunities to develop the changing skills required by employers of Professional Writing and Publishing graduates.

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[eScholar 2011 Rachel Robertson - Case Study Video](http://youtu.be/0rXDQH4Cgeg)

<http://youtu.be/0rXDQH4Cgeg>

The use of online debates in teaching pharmacotherapy

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KEYWORDS

Debates, critical thinking,
argumentation skills,
pharmacotherapy

Abstract Given changes in the final year pharmacotherapy unit structure and calendar, along with a need to introduce assessments to encourage critical thinking, it was decided that online debates of therapeutic controversies would be beneficial. The primary objective was to assess the impact of teaching strategies on the development of argumentation skills and informal reasoning in pharmacy students. Students were provided with an introduction to argumentation followed by two formal debates, with feedback provided in between. Four debate groups were randomly selected for evaluation. In debate one, all groups posted one argument and all arguments were rationalistic and ranked as Level 3. For debate two, a total of 33 arguments were evaluated, with an overall median ranking of Level 2. Again, all debates were categorised as rationalistic. In general, students felt there was too much workload associated with the assignment. Changes in the future include providing the debates in patient scenarios to increase practical applicability.

Background

Context:

Pharmacotherapy teaching at Curtin University has traditionally involved the lecture and tutorial format common to most units. Lectures, presented in a didactic format, are given on a variety of topics ranging from nutrition to oncology, by experts in the field. The tutorials are meant to consolidate learning from the lectures by putting them in the context of patient cases. Little change from this model of teaching pharmacotherapy has been made over the last number of years. The adoption of a blended learning environment was necessary in light of administrative and logistical changes to the fourth year pharmacy calendar. In Semester 1, 2011, fourth year students were only going to be on campus for six weeks of term. This was preceded by six weeks of clinical placements. The constriction of face-to-face time led to reconsidering how the Pharmacotherapy unit could be better delivered. It was decided, in conjunction with the fourth year coordinator and other pharmacotherapy lecturers, to implement an online component in order to reduce the number of face-to-face tutorials in the six weeks of time spent on campus.

In addition to this, it was felt that the introduction of an assessment that focused on critical thinking skills would be beneficial. Pharmacy students require the development and growth of a multitude of skills during their four years of training. These include communication skills, evaluation and interpretation skills, as well as critical thinking (Australian Pharmacy Council, 2009). These skills are part of accreditation standards in various jurisdictions (Australian Pharmacy Council, 2009; Accreditation Council for Pharmacy Education, 2011), and as such require activities that foster and assess these skills.

The Australian Pharmacy Council Accreditation Standards (2009) specifically state (p. 10) the following:

- Graduates from a pharmacy program should be able to have the following generic attributes:
 - Communication: the ability to communicate information, arguments and analyses effectively
 - Critical thinking: the ability to analyse issues logically, consider different options and viewpoints, and make informed decisions.

Rationale:

Clinical decision making and problem solving with regard to patient care are difficult skills for pharmacy students to master, as they involve critical thinking skills. The problem with the majority of teaching and learning in pharmacy education is that it promotes rote learning (Taylor, 2007). Students often cite this as a preference in terms of learning strategy as it has either previously brought them success, or requires less mental fortitude than a strategy that would incorporate deeper learning (Novak, 2003).

Debate and argumentation have been proposed and evaluated as a method to develop these skills (Erstad, 1994; Lieberman et al 2000; Saito & Fujinami, 2011). Informal reasoning, which is the thought process that is involved in working out contentious problems with no clear answers, is also part of the argumentation process. Bloom's taxonomy identifies critical thinking and reasoned argument as high level thinking associated with evaluating skills (Krathwohl, 2002).

Debates allow students to not just identify that there is a problem or issue to resolve, but also a deeper analysis of the issue at hand. This includes identification of evidence, appraisal and critique of evidence and reasoning of the issue for a potential solution.

These skills are also necessary as health care professionals are inundated with new evidence all the time; and appraisal and critique of evidence is the only way to separate the valid from the invalid.

Debates have been used in tertiary education of health care professionals. For example, in a graduate level periodontics course, introduction of a debate assignment was evaluated

(Saito, 2010). The assignment focused on information collection, analysis and evidence-based discussions. The debates were judged by faculty using undefined, invalidated criteria. The students also participated in a pre and post-test which showed no difference in their understanding of concepts (Saito, 2010).

In an earlier study, debates in a medical unit were evaluated using focus groups and surveys (Liebermann, 2000). The students perceived the debates as exercises in critical thinking not content acquisition, and the debates promoted research-analysis skills. The most common complaints from the students were related to both workload and time (Liebermann, 2000).

In terms of the pharmacy setting there are a few examples in the literature describing the use of debates in curricula. A pharmacy course focusing on the United States of America (USA) health care system included debates in their course, however the study did not analyse any of the debates or investigate critical thinking, reasoning, or level of argumentation by the students (Poirier, 1997). The majority of students (80%) felt the learning activity should be repeated again and the major complaint associated with the debates was that the students had to work as groups. This was similar to another study that looked at the introduction of online debates to discuss issues of controversy in the health care system of the USA (Lin, 2007). In this study, the researchers evaluated the assessments by using thematic analysis of qualitative data collected from the online debates and student evaluations of the course. They concluded that there was an increase in enthusiasm and depth of knowledge from the students; however, they include no explanation as to how their analysis was conducted.

Another example of debates in pharmacy curriculum was in a post-graduate course for pharmacy students. Topics included primarily regulatory issues. Again, evaluation of these debates was ad hoc by faculty, with invalidated methods being used for analysis (Sookaneknun, Suttajit, Ploylearmsang, Kanjanasilp, & Maleewong, 2009). A pharmacokinetic course at University of Tucson included a debate component as an assignment (Erstad, 1994). Again, faculty evaluation of the debates was conducted in a similar manner to the aforementioned studies where no specific validated measure was used to assess the student's level of debate or critical thinking skills.

Problem to be solved:

Given the changes in the unit structure and calendar, along with a defined need to introduce assessments designed to encourage higher level, critical thinking, it was decided that online debates of therapeutic controversies would be beneficial in addressing the problem. In addition, a validated method for analysis of argumentation and informal reasoning would be employed to improve upon methods used in previous studies.

Research objectives:

The specific research objectives were to:

1. Assess the impact of teaching strategies on the development of argumentation and informal reasoning skills in pharmacy students.
2. Assess the impact of teaching strategies on student perceptions of learning argumentation and informal reasoning skills as taught in the context of pharmacotherapy.

Approach

During orientation to the unit, students were provided with a brief introduction to argumentation and given a scenario of its potential usefulness in practice ([Appendix 1](#)). Students were also given a brief overview of requirements of the assessment.

Students were asked to split themselves into groups of 3-5 students.

Two debates were scheduled during their six weeks of term spent on campus (weeks 7-12 of semester 1, 2011). The first debate was for formative feedback only. Students were to engage in the online debate, with participation ending on a specified date, approximately two and a half weeks after the start date. Topics included pharmacotherapy related concepts from their previous pharmacotherapy units. After this time, feedback was provided to the class as a whole during lecture time. The main points of feedback related to better structure of their argument using Toulmin's (2003) argument structure (see Figure 1) as presented during orientation. After this feedback was provided, students were assigned debate two, with different topics, associated affirmative and negative positions, and different teams. The second debates were based on topics from their current pharmacotherapy unit and were graded as part of their final assessment. Each group was sequentially assigned a topic and nominated either an affirmative or negative position to argue.

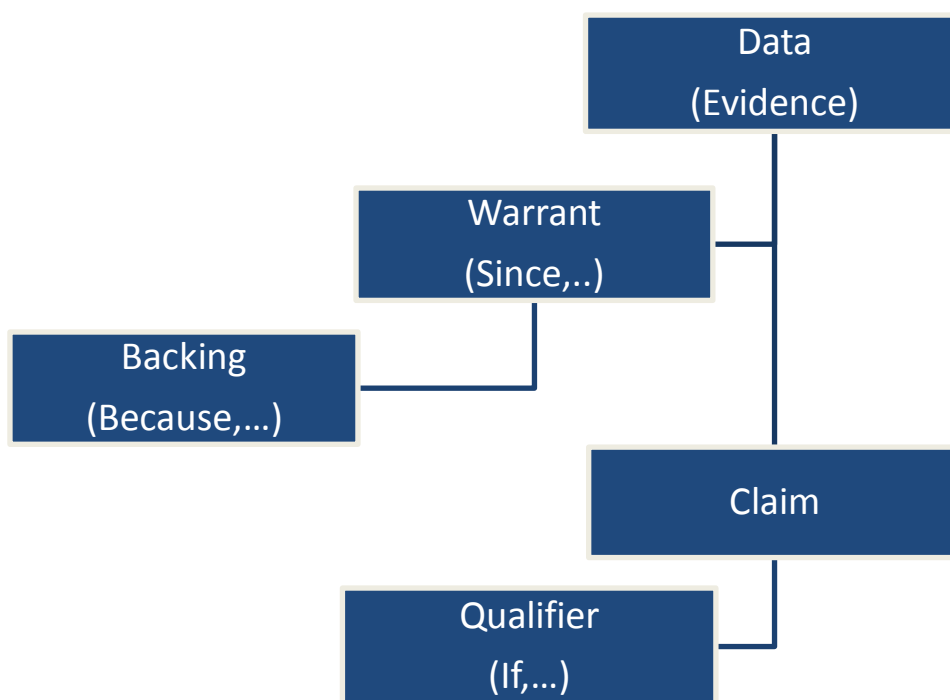


Figure 1: Toulmin's Argument Diagram (adapted from Toulmin, 2003).

Students were provided with the criteria on which the debates would be marked. Overall, 90% of the assessable marks for the activity were based on the group debate performance (see breakdown below):

Participation (online presence and engagement in the debate) 30%

Evidence provided 30% (including evidence evaluation)

Did you use evidence to strengthen your debate?

Did you critically evaluate the evidence you used?

Did you provide references for evidence you used?

Strength of argument 30%

How convincing is your argument?

Did you follow a concise and consistent format to your argument structure (e.g. Toulmin's argument structure (2003))?

The remaining 10% of marks was based on an individual performance in producing a final report where students were asked to consider the following points:

- Did the debates help reinforce material learned in the lectures and tutorials?
- What challenges did the debate assignment pose to you?
- Can you see a usefulness of this skill in practice? Why or why not?

The students were encouraged to not use the final report as an evaluation of the assessment per se, as that could be done using eVALUate, Curtin's online system for gathering and reporting student feedback on their learning experiences.

Technology:

Debates were conducted online at www.createdebate.com. The site is a public domain that allows anyone to create a login and participate in debates ranging from political to entertainment based issues. The site has a private feature that allowed the pharmacotherapy debates to only be seen by the students enrolled in the unit. A domain specific to the unit was created (<http://curtinpharmacy.createdebate.com/>) and students were provided with information to create a group specific login.

The site was set up with a separate webpage for each debate, with the affirmative and negative positions clearly labelled (see Figure 2). The administrator (Unit coordinator) checked the posts weekly to ensure groups were engaging in the debates and that student posts remained topic focused.

The website has a rudimentary ranking system for individual posts and rebuttals. Students were advised that they would not be marked based on the ranking generated using the in-built ranking system. However, the system did allow for easy viewing of the number of posts each group had made over the course of the debates.



Figure 2: Example debate on www.createdebate.com

Participants:

All students (n=136) in a final year pharmacotherapy (therapeutics) unit were invited to participate. Ethics approval for the study was granted by the Curtin University Human Research and Ethics Committee.

Method:

The study was a pre-test/post-test pre-experimental design (Creswell, 2008) (see Figure 3). Four debate groups were randomly selected for evaluation of level of argumentation and category of informal reasoning (Venville & Dawson, 2010). Each group was assigned a number and the True Random Number Generator tool (www.random.org) was used to select four groups. A comparison of the debates before and after formative feedback was conducted, assessing both informal reasoning and level of argumentation (see Figure 3, Table 1, Table 2).

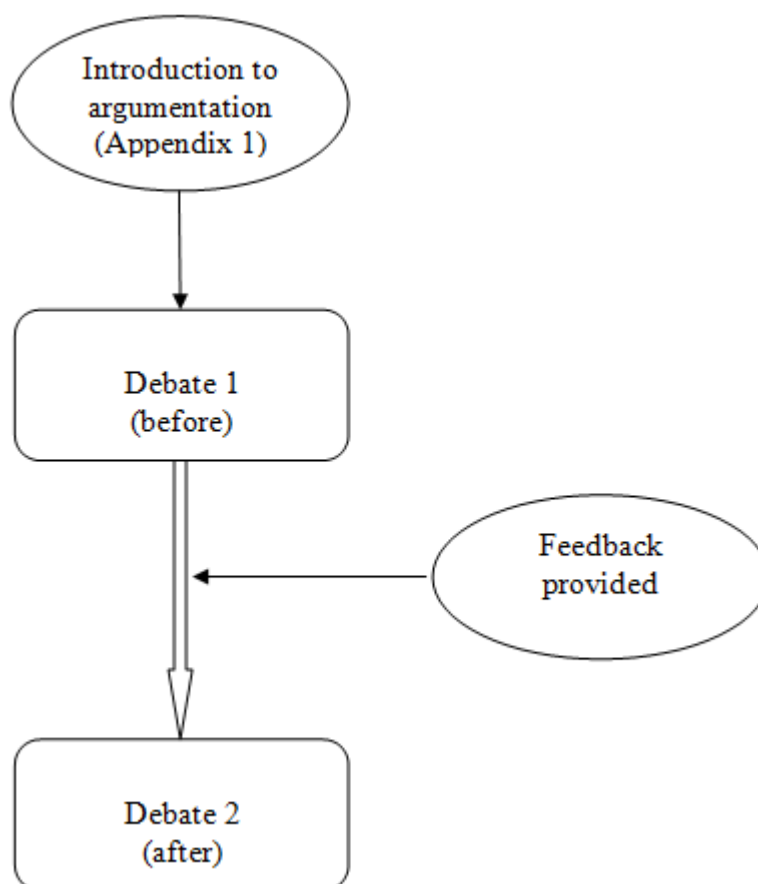


Figure 3: Study design - ovals represent teaching-related actions and rectangles represent learning activities.

In this study informal reasoning is defined as the reasoning students engage in to work out contentious problems without clear-cut solutions. Argumentation is defined as the expression of informal reasoning (Sadler & Zeidler, 2005). Debate is the term used to describe the overall topic (i.e. Is Cranberry juice effective in reducing the risk of urinary tract infections in the elderly?). Argument is the term used to describe each discrete post submitted by a group to support their side of the debate.

Informal reasoning was assessed by two independent reviewers. The categories described by Sadler and Zeidler (2005) were used to categorise each debate type (see Table 1). Disagreements were resolved by discussion and consensus.

Table 1: Categories of Informal Reasoning

Category	Description
Rationalistic	Logical Scientific reasoning
Emotive	Empathic, sympathetic Focused on human elements
Intuitive	Gut feeling Immediate Response

Each group post was also assessed for level of argumentation and the process used for evaluation followed an adapted version of Toulmin's Argumentation Pattern (TAP) (Toulmin, 1958) that was developed by Venville and Dawson (2010) (see Table 2). The posts were assessed independently by two reviewers. Disagreements were resolved by discussion and consensus.

Table 2: Ranking of Arguments

Level of Argument	Description
1	Claim The conclusion, proposition or assertion
2	Claim, data (the evidence that supports the claim), and/or warrant (an explanation of the relationship between claim and data)
3	Claim, data/warrant, backing (basic assumptions to support the warrant) or qualifier (conditions under which claim is true)
4	Claim, data/warrant, backing and qualifier

Note. Based on Venville & Dawson's (2010) adapted version of Toulmin's Argumentation Pattern (TAP)

Descriptive statistics were used to analyse the data (i.e. informal reasoning categorisation and argument ranking for debate entries), along with a calculation of kappa with linear weighting to determine level of agreement among reviewers.

Findings

Results:

Debates from four randomly selected groups (out of a total of 34 groups) were analysed. As groups were allowed to post as many arguments as they wanted during a set time period (three weeks), each group had a different number of arguments that were analysed over the study period.

When categorising informal reasoning for debate one, reviewers had 100% agreement. For measure of concordance when assessing level of argument, the calculated kappa was 0.63.

In debate one, all four groups posted one argument which was analysable. All arguments were rationalistic and ranked at a Level 3 (100% of posts).

For debate two, a total of 33 arguments were evaluated on level of argumentation and informal reasoning. The median number of debate posts per group was 7.5 (range 4-14). Again, as with debate one, informal reasoning was categorised as rationalistic in 100% of debates. Table 3 shows the average level of ranking for arguments by each group.

Table 3: Post-feedback (debate two) ranking of arguments

Debate Group	Number of Arguments posted	Median Ranking of Arguments (range)
1	8	2.5 (2-3)
2	4	2.5 (2-3)
3	14	2 (1-3)
4	7	2 (2-3)

Overall, students were proficient at providing data for each claim they made; 94% of arguments in debate two were Level 2 or higher. Students provided significant amounts of evidence in each argument; several arguments had five references provided as their evidence.

In terms of Level 3 arguments, in debate one, 75% of arguments were categorised as level 3 based on having a qualifier. In debate two, 50% of level 3 arguments had qualifiers and 50% had backing.

Analysis:

Students were presented with an entirely different type of assessment, in comparison to previous assessments conducted within their pharmacotherapy units, with this debate assignment. The activity required them to engage in a variety of experiences including group work, online learning, researching, writing, evaluating, analysing and communicating.

Analysis of debate one showed that students required a lot of encouragement to actually engage in the activity. It took until the day before the due date before any arguments were posted, and then, as evidenced in the results, very few arguments were posted at all. Some groups (not analysed) posted no arguments. However, the arguments that were posted were of high quality, as they were all Level 3. None of the posts involved any type

of rebuttal, given that only one argument per team was posted. Consequently, no interaction between the groups had occurred. Also, none of the arguments posted in debate one followed the argumentation structure provided to them in the orientation (see [Appendix 1](#)).

Debate two required less encouragement to get arguments posted, possibly as it was part of the student's formal assessment structure. Students seemed to be focused on posting as many arguments as possible (even though they were told the focus was quality not quantity) and this could be an explanation as to why the level of argument was slightly lower in debate two. The number of arguments posted in debates increased from debate one, and the other major difference was that students engaged in rebuttals. There was actual interaction between groups, including addressing and responding to arguments. In debate two, students were also more consistent with labelling their arguments (claim, data, backing, qualifiers) as recommended during their feedback between debate one and two. However, as arguments were reviewed, it became evident that student's labels were not consistent with reviewer's labels. For example, data provided from research was often labelled as a qualifier or backing by students. This lack of consistency indicates that student may not have fully conceptualised argumentation from the brief introduction provided during unit orientation. Venville and Dawson (2010) found that groups of high school science students who had received specific training in argumentation produced arguments of improved complexity and quality in comparison with groups that did not receive specific training.

In terms of student reflections and comments the main themes were related to workload, applicability and feedback. Students in general felt the workload for this assessment (weighted at 15% of their final mark for the unit) was too much. They spent a lot of time meeting with their group members and searching for data to support their side of the debate. Interestingly, even though the debate was presented to the students as an opportunity to reduce on campus time, the students still felt the need to meet with their other group members in person; thereby diminishing the flexible learning environment the task was meant to provide.

For applicability of the skills being taught and fostered through this assignment the students had a hard time processing that these skills were applicable in 'real life'. They were provided with an example in the introduction to the unit ([Appendix 1](#)) to give the task some context, however students were not able to link this to the applicability of the skills. In the feedback session between debate one and two, how the skills applied to succeeding in the final exam seemed to resonate with some of the students; however, the practical nature of the task still was not apparent to them.

The students also felt that in general, the feedback provided was too generic and not directed enough. The students overwhelmingly wanted specific feedback for their group, rather than the class as a whole.

Answers to research questions

1. Assess the impact of teaching strategies on the development of argumentation skills, critical thinking and informal reasoning in pharmacy students.

In conclusion, the introduction provided to students on argumentation, led the students to have a high level of argument (level 3) from the debate one, however feedback provided little additional improvement in their level of argumentation. Their level of informal reasoning (rationalistic) was appropriate to the type of debates given.

2. Assess the impact of teaching strategies on student perceptions to learning argumentation skills, critical thinking and informal reasoning as taught in the context of pharmacotherapy.

Students had a hard time trying to associate the debates with real life scenarios and felt that there was little contextual application to the skills. This will encourage teaching staff to change the style of debate to a more patient/case focused scenario to improve applicability to students. Students were able to develop and apply their rationalistic informal reasoning to debates that would be similar to what is seen in practice.

Conclusion

What worked well?

Firstly, the website worked well for the debates. The site was easy to navigate and post on, and students had no complaints or concerns over using it. The site set up is similar to social media sites, therefore the majority of students could relate to the format, and hopefully it made it more engaging for them and encouraged participation.

The two debate system seemed to work as well, in terms of providing the students with some breadth in topics covered. Debate two uptake was quick and students were consistently verbose with their claims, justifications and rebuttals. The amount of posting and quality of arguments is evidence to the fact that the students worked hard at making debate two worthwhile and engaged in lively and timely rebuttals. The second set of debates were engaging and entertaining to read – and hopefully were engaging and entertaining for the students to participate in.

Finally, the introduction of this type of assessment, with the introduction of new skills related to critical thinking and argumentation, worked well with the unit. It offered a new type of assessment to the unit, and gave added dimension to the types of assessments the students engaged in during the unit. Moreover, it helps to further develop the overall pharmacy curriculum to meet specific guidelines as set out by the Australian Pharmacy Council, as well as aligning with the Curtin Graduate Attributes (Curtin Graduate Attributes, 2011).

What could have been done differently and Implications for implementation?

In terms of changes for 2012, the focus will be on presenting the debates in a more patient focused way – using patient cases. The students had a hard time trying to understand the practical significance of the skills related to debating; therefore using a more practical setting may help to increase the level of applicability for the students.

Students' level of argument did not increase between debate one and two. As speculated in the results section, this may be due to the number of arguments students posted during debate two. Students were told that the focus of the assessment was on the quality and level of debate, including evidence provided, however, they still seemed quite focused on the need to post more and more arguments. This may be related to the site itself, which ranks debates (winning or losing) based solely on the number of arguments posted under each debate. The students would see this number and ranking every time they logged in, which may have encouraged them to focus on continually posting. This will need to be discussed further with the site administrators to determine if it can be adjusted for our purposes.

The major issue was getting the students to actually engage in debate one. Students had to be told numerous times in class, and via Blackboard, to become involved in debate one. This did not affect the level of argumentation in debate one, however given how few arguments were actually posted, may not be an accurate representation of the students' understanding, at that time point, on argumentation. For 2012, the marking rubric may be modified to allow for some marks to be provided for participation in debate one.

The students also consistently stated that they would like more directed personal feedback between debates one and two, rather than generic feedback provided to the whole class. Teaching staff will discuss different options, but likely written feedback provided to each group will be instituted. Whether or not this feedback can be delivered directly on the website will be further explored.

Finally, it was evident that students require more guidance and information to fully conceptualise argumentation than a brief introduction to the concept at orientation. Therefore supplementary online resources and exemplars will be developed for 2012.

Implications for future research

With the modifications proposed to the unit, and improvements in the practical nature of the debates, it will be useful to redo the measurements of informal reasoning and level of argumentation. Although the majority of arguments were Level 3, there were no Level 4 arguments; future research will identify the impact of supplementary resources to improve the complexity and quality of arguments produced.

In addition to this, it would be useful to measure the level of critical thinking itself. In this study, argumentation and informal reasoning were surrogate markers for critical

thinking. The underlying assumption is that by improving argumentation, that students level of critical thinking was subsequently improved, however this was not measured directly. Future research could employ methods to measure this (McMillan, 1987).

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[eScholar 2011 – Teri Charrois – Case Study Video](http://youtu.be/eDwkIE4XGs0)

<http://youtu.be/eDwkIE4XGs0>

Appendix 1

Tutorials

- Have 6, 2 hour face-to-face tutorials
 - Integrative cases
 - Cover new topics and incorporate prior learning
- Other tutorial time (2 hrs/wk) will be for online learning
 - Part of the eScholar program
 - Integration of blended learning into courses

eScholar

- Aims to support academic staff from across the university to implement new technologies in learning and teaching
http://cel.curtin.edu.au/strategic_initiatives/escholars/eScholars2011.cfm
- Online debate to develop critical thinking skills in clinical decision making

Why Debate?

- By discourse and argument, science (pharmacy, medicine) remains objective
- Critique and debate are **CORE** to the practice of science (medicine)

Why Debate?

- Learning is not a process of transmission
 - You sit, I dump information, you memorise
- Learning to argue is important to thinking and understanding/constructing new ideas

Debate

- Clinical controversy
- No right-or-wrong
- Shades of grey



Toulmin's argument diagram



What does an argument look like?

- Claim
 - A statement you want someone to accept
- Grounds/Data
 - Data and reasoning behind the claim
- Warrant
 - Shows the grounds to be relevant
- Backing
 - Gives additional support to claim
- Qualifier
 - Most, usually, always, sometimes
- Rebuttal
 - Pre-empt a counter-argument

An example...

- A regular in your pharmacy has not picked up his new prescription for Ramipril 10mg daily. He's an overweight, 68 year old male who smokes. You give him a call to discuss.

He tells you:

"I don't think I need to take this Ramipril every day because I don't feel sick"

You could say

- Well your doctor prescribed it so you obviously need it.
- That's fine, I'll just cancel that prescription.
- Are you crazy?? Your blood pressure is through the roof!!

Or you could try and convince him...

Example

- **Claim:** You should be on an anti-hypertensive
- **Grounds/Data:** your blood pressure is 170/90
- **Warrant:** high blood pressure can cause CV disease
- **Backing:** you've had high blood pressure on 3 different occasions
- **Qualifier:** You are at high risk for CV disease also because of your age and family history
- **Rebuttal:** Most people don't have too many side-effects on anti-hypertensives

Debating has a role in...

- Discussing issues with patients
- Discussing issues with other health-care providers
- Discussing issues with colleagues

How does it work?

CreateDebate

- For first 6 weeks
 - Learn debate-specific terminology
 - Upload to Blackboard
 - Split yourselves into groups of ~4 based on your tutorial groups
 - Need 6 groups per tutorial
 - Give your 'team' a name – email me group members and name
 - Poke around on the site
 - I'll 'invite' you once everything is ready to go

How does it work?

- During Block
 - You will be assigned a topic and a side (pro or con) to debate with another team
 - You will have 2 debates over the course of the 6-weeks
- First debate
 - Practice - no marks
 - Feedback on your participation and strengths of arguments provided
- Second debate
 - For marks
 - Participation, Evidence provided, Strength of argument, and Final report

You will not be marked on

- Your conclusion to the argument i.e. no right or wrong answer
- If you provide incorrect evidence, that's different

You will be marked on

- Participation (30%)
 - Online presence
- Evidence provided (30%)
- Strength of argument (30%)
 - How convincing are you?
 - Think about your data, warrant, backing
- Final report (10%)
 - One page
 - Reflection of the experience

What do I want you to get out of this?

- To be able to link theory with evidence
- To *think*
 - Not just relay what it says in the textbook
- To model your answers based on specific patients

Using digital learning technologies to enhance students' learning experiences in the first year of university

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KEYWORDS

Interprofessional
education, clickers, wikis,
digital video

Abstract The introduction of a common first year among all health science students at Curtin University in 2011 presented a challenge to engage large classes of students from diverse health disciplines and entry pathways to university. A range of digital learning technologies were trialled in one core compulsory unit of the common first year to increase engagement and collaboration among interprofessional groups of students. Students enrolled in Evidence Informed Health Practice 100 were invited to complete an online survey to evaluate the technologies trialled. Students' opinions of the technologies trialled were mixed. Audience response devices were highly valued as a tool that engaged students in a large class environment; provided formative feedback, and allowed individuals to share opinions without being identified. Students reported contributing to the student-authored wiki summary of weekly learning concepts did not assist them in understanding the learning concepts. Successful application of learning technologies can be enhanced by supporting teaching staff to confidently use the technology, and ensuring the physical learning space including internet connectivity, can support the technologies.

Background

There is support at an international level for the inclusion of interprofessional education (IPE) in tertiary education programs to improve the quality of patient care by health care professionals (Hammick, 2007). IPE is defined as “occasions when members (or students) of two or more professions learn with, from and about one another to improve collaboration and the quality of care” (Hammick, 2007, p. 736). In recent years, the Faculty of Health Sciences at Curtin University introduced opportunities for IPE through clinical fieldwork experiences and case-based classroom activities (Curtin University, 2011); however, in 2011 a common first year for all health science students was introduced, thereby creating even greater opportunities for IPE.

In 2011 the common first year of study in Health Sciences was taught to approximately 1800 students from a range of health science disciplines including biomedical sciences, nursing and midwifery, occupational therapy, pharmacy, physiotherapy, psychology,

public health, social work, and speech pathology. Approximately 300 students were enrolled in Semester 1, and the remaining 1500 students were enrolled in Semester 2. The common first year of study is comprised of five compulsory core units and discipline-relevant elective units, which are studied across two academic semesters. Students from all health science disciplines attended class with each other, where learning activities focused on collaboration and sharing of knowledge among students.

Research focussing on factors influencing academic success in the first year of tertiary education has identified several important issues. First, massification and internationalisation of tertiary education has resulted in alternative pathways for entry to university; and consequently first year students present as a diverse cohort from a range of ethnic, socio-economic, academic aptitude and geographic backgrounds (Scutter & King, 2010), that create challenges and barriers to learning. Second, international students, especially those from non-English speaking backgrounds, face challenges in completing a course of study in a language other than their native tongue and integrating socially into the classroom and social environments at university. International students at an Australian university were found to have difficulties in understanding information presented in face-to-face lectures due to the colloquial language used and the fast rate of speech among teaching staff (Ramsay, Barker, & Jones, 1999). Furthermore, international students from Asian countries have been characterised as being teacher-dependent, passive, unwilling to question teaching staff, and focussed on a rote-learning approach rather than applying critical enquiry (Major, 2005). Third, over half of Australian tertiary education students studying full-time juggle their studies with part-time work (Krause, Hartley, James, & McInnes, 2005) and family responsibilities, creating competing demands for time available to complete learning tasks. Finally, retention of first year university students has been associated with a sense of belongingness to the academic and social environments present. Students who do not engage and create bonds with academic staff and their student peers are more likely to not successfully complete their first year at university compared to students who develop these academic and social connections at university (Johnson et al., 2007). Social networks formed at university develop to become the main source of emotional support for many students while at university (Wilcox, 2005). Interactive and collaborative learning methods, such as those based in IPE, can facilitate students' relationships with academic staff and their student peers and improve student success in the first year at university.

In order to address these factors influencing first year student success, the challenges for academic staff delivering the common first year of study at Curtin University were to: (i) manage the increased class sizes to accommodate all internal students (studying on-campus) in metropolitan Perth and at two regional campuses, as well as the large number of external students (studying fully online); (ii) maintain quality, accessibility and relevance of the learning resources, and (iii) engage a large cohort of students in IPE collaborative learning in, and out of the classroom.

These challenges required a shift to more flexible delivery of learning materials and activities, utilising a range of digital learning technologies to engage large cohorts of first year students involved in common introductory units using an IPE approach. This paper describes an evaluation by students of the digital learning technologies trialled in one of the compulsory core units of the common first year of study.

Method

Study design

A cross-sectional study design was used to determine students' attitudes towards the different digital learning technologies used in Evidence Informed Health Practice 100 (EIHP 100).

Participants

All undergraduate students enrolled in EIHP 100 in Semester 2 2011 (N= 1484) were invited to participate in this study. Eligibility to participate in the study was dependent upon enrolment status; internal (attending classes on campus) and external (completing the unit fully online) students were eligible. Ethics approval to conduct the study was granted by the Curtin University Human Research Ethics Committee. Participants were provided with information in the preamble to the survey about the purpose of the study, their right to voluntary participation or refusal, risks and benefits of participation, and assurance that their responses would remain anonymous was given. Participants were asked to provide their informed consent to participate in the study, prior to answering any survey questions.

Description of the unit purpose and content

Evidence Informed Health Practice 100, a compulsory foundation unit was introduced into the common first year in the Faculty of Health Sciences at Curtin University in 2011. The unit syllabus included the various forms of evidence that are used to inform health practice; the role of empirical evidence in making decisions in health practice; the use of different research designs in addressing health practice questions; and processes for critically evaluating the evidence and determining its value in answering health practice questions.

Description of the learning style for EIHP 100

Learning activities for the EIHP 100 unit were provided either face-to-face in a classroom setting on-campus or fully online via the learning management system (Blackboard). On-campus students were required to attend a weekly two hour seminar-style class, with class sizes of up to approximately 100 students. Students registered themselves into one of 15 available class times. In the first week, students in each class were randomly allocated to one of (up to) 16 teams. Each team was comprised of six students and team composition was re-arranged if necessary, to ensure that each team

included students from a range of health science disciplines in order to provide students with opportunities to engage in IPE. Students enrolled in an external mode of study were placed into a 'virtual team' of six with other external students from a range of health science disciplines, and were encouraged to communicate with their team members via email.

Each IPE team was asked to assign a name and icon for their group, and share their contact details with other members of their team. Students remained in each of these IPE teams for the duration of the semester. Students were asked to contact their tutor and team members to advise them if they were going to be absent or late to class, in an attempt to encourage professional behaviours among first year health science students.

The weekly learning activities were structured around three stages of learning: (i) preparation; (ii) participation, and (iii) review. Preparation involved accessing readings and activities that were available through Blackboard in the week prior to each class. Students were required to view pre-recorded lectures, access any relevant online videos and websites, and complete preparatory readings to support the learning activities to be covered in class. Participation in the weekly learning activities required students to work both independently and in their small teams to complete case scenario activities, interpret statistical data, and learn about different research methodologies. To complete the review stage of learning, one IPE team was randomly selected at the end of each class to write a summary of the learning activity for that week; what concepts were covered; their relevance to evidence-based practice, and aspects the team found challenging or interesting. This summary was posted on a weekly wiki on the EIHP 100 Blackboard site.

There were three tutors (from different health profession disciplines) in each class to facilitate the learning activities and answer questions. This also modelled the IPE approach to the students' learning activities and experience.

Description of the physical learning space

The physical learning space for this class was a large single-level lecture theatre that had been refurbished in consultation with the unit coordinator for EIHP 100, to promote collaborative small team learning. The learning space was approximately 17m x 15m with 16 groups of six tables and chairs. Each group of tables included access to electrical power for students using mobile technologies such as laptop computers.



Figure 1: A tutor facilitating interprofessional team work in EIHP 100

Four large projection screens were placed on each of the four walls of the learning space to allow students a clear line of vision to projected images, regardless of their position or orientation in the room. The tutors facilitated the learning activities from the centre of the learning space, and during class activities were available to provide support to each team as required (see Fig. 1).

Digital learning technologies trialled

The digital learning technologies trialled in EIHP 100 included:

- i. large projection screens positioned around the classroom providing visual access to teaching materials used in class;
- ii. digital video clips (via YouTube) that provided students with examples of health research topics and case scenarios that complemented the information provided in lectures, pre-readings and classroom discussion;
- iii. in-class access to laptop computers with internet access to allow students to research information and resources for team learning activities;
- iv. audience response devices (also known as 'clickers') that provided students with the opportunity to anonymously answer multiple-choice questions relating to the learning concepts being discussed or to provide agreement/disagreement on ethics and other issues related to research;
- v. a wiki posted on the Blackboard site by a randomly selected IPE team in each class each week (including external student IPE teams), that provided a summary of the learning concepts covered that week. Other teams were encouraged to read the wiki summaries and post feedback to the contributing team. This provided students with a students' perspective of the learning concepts;

- vi. iLectures available via the EIHP 100 Blackboard site. Given that it was not possible to physically accommodate all enrolled students in one lecture theatre, the common first year units abolished face-to-face lectures replacing them with pre-recorded lectures in an MP3 format that students could download to mobile technologies such as laptops, smartphones and tablets, and watch prior to attending (or completing online) interactive learning tasks;
- vii. Elluminate *Live* sessions – these were scheduled with external students in the weeks leading up to the submission of the written assignments for the unit. This provided students with the opportunity to talk directly with a tutor to ask questions and clarify understanding. Students with an internal mode of enrolment (i.e. attended classes on campus) could access a face-to-face meeting with their tutor to receive assistance in understanding the learning concepts.

Method of evaluation

Students were surveyed using an online survey via Survey Monkey. An invitation to participate in the study was placed as an announcement on the EIHP 100 Blackboard site, and was copied to the student email addresses of all students enrolled in the unit. A link to the survey was embedded in the invitation, and as no login or use of an identifying name, student number or password was required, all responses were completely anonymous and could not be used to identify any individual student.

Data analysis

Simple descriptive statistics in Excel were used to determine percentage agreement with each of the statements in the survey. Content analysis of qualitative responses in the survey was used to identify major themes or issues common to respondents.

Results

Demographics of participants

Of the 133 EIHP 100 students who consented to be in the study and completed the online survey, the majority were female (88%); reflecting the higher representation of females enrolled in each of the respective health science disciplines at Curtin University. A large majority of students were enrolled in the internal mode of study (88%), and overall most students fell into the 18 – 24 age group (59.5%), as shown in Table 1.

Table 1: Demographic data of study respondents (N=133)

	Response %
Gender	
Male	12.0
Female	88.0
Age	
< 18 years	3.2
18-24 years	59.5
25-29 years	9.5
30-39 years	13.5
40-49 years	11.9
50 + years	2.4
Mode of study	
Internal	88.0
External	12.0

Blackboard learning management system resources

Participants were surveyed about the value of the learning resources provided on Blackboard including downloadable iLectures, weekly readings and the weekly summaries of learning concepts provided by students via the wiki. Participants selected one of four responses on a four-point Likert scale (Strongly agree/agree/disagree/strongly disagree). Responses were aggregated into two categories (agreement versus disagreement) to provide an overall picture of student attitudes. The statements provided and participants' responses are presented in Table 2.

Table 2: Percentage agreement with survey items

Survey items	Strongly agree/ Agree (Response %)	Disagree/ Strongly disagree (Response %)
The learning materials were easily accessible via	91.2	8.8
The online iLectures allowed me to access the lecture material at a time that is convenient for me	88.7	11.3
Being able to review the online iLectures as many times as I need has helped me to understand the learning concepts	76.6	23.3
Contributing to the wiki summary has helped me to understand the learning concepts	33.9	66.1
The wiki summary provided by other students has helped me understand the learning concepts	32.2	67.6
Participating in learning activities within a small team has provided me with learning support from fellow students	59.6	40.3

In-class and online learning technologies

Participants enrolled in an internal mode of study (i.e., attended classes on campus) were asked to identify the learning technologies they found useful for facilitating their learning in EIHP 100. Ninety-five participants completed this question and were positive about the usefulness of the technology in supporting their learning. General feedback was that the in-class technologies were interactive and actively engaged students in their learning. Respondents who reported they were 'visual learners' benefitted from an alternative to information provided via written word alone.

Large projection screens

Eighty-one per cent of respondents identified the four large screen projectors as being important in facilitating their in-class, team-based learning experience, especially due to the large class size. Qualitative responses included:

"Having the large projection screens helped to keep up with the material that would be discussed in class, to help me in my own thoughts and ideas about the discussion."

"Multiple screens enabled various viewing angles, while remaining focused in a group."

"The screens were all around the classroom so we did not have to face a single screen, and it made group activities easier."

Audience response devices

Approximately 66% of respondents reported the audience response devices that provided anonymous responses to questions/statements were beneficial to their learning in EIHP 100. Respondents reported the use of the response devices *"changed the tempo of the class and made it interesting and interactive"*; and facilitated students' participation with the class activity; with one survey respondent noting *"the interactive nature of the clickers was fantastic in getting people involved."*

Respondents who were not comfortable in speaking up in front of a large class, found the response devices were a useful way to confirm they understood the content being discussed in class in a safe environment. The fact that responses provided were anonymous was a common theme among the survey participants, as demonstrated in comments such as: *"The clickers were a good way to test knowledge and improve confidence with the anonymous results"*, and *"the anonymity of my responses was appreciated."*

Survey respondents were also interested to know what their fellow students' responses were to multiple choice questions (MCQs) or about others' agreement/disagreement with issues raised in class discussions. They appreciated the opportunity to discuss the diversity in student beliefs and perceptions on a particular issue without individual students being identified.

Digital video resources

Over half (54.2%) the survey respondents found the information provided via YouTube videos useful in facilitating their learning. These videos were accessible to internal students in class, and to external students via the respective links embedded in the weekly Blackboard preparation and learning activities.

The video resources were found to provide a way to explain ideas more clearly, provide different examples of a concept, and put the learning outcomes into a real world context. Respondents found the videos provided complementary information in short durations, were interesting to watch, and provided a 'break' from the tutors speaking.

Laptop computers

Only one-third of respondents found the laptops provided for in-class activities useful in facilitating their learning. Difficulties with logging in and insufficient wireless connectivity were reported as technological issues that negatively impacted on the potential use of this digital learning resource, and contributed to students' frustration, as noted in the following comments.

"Laptop computers did not work due to students unable to log in, but would be useful if this issue did not arise."

"... most of the time the laptop computers did not work, which made things frustrating when we were told we needed to access a computer."

Participation in Elluminate Live tutor support sessions

Four of 15 respondents who were enrolled in an external mode of study (i.e., fully online) responded that they participated in the scheduled Elluminate *Live* sessions with a tutor. Those students who participated in Elluminate Live provided positive feedback, including:

"I found it good to be able to ask (my tutor) questions directly and get personalised answers. I also picked up some information from listening to (my tutor's) conversations with the other student that participated in the session I did."

"It was reassuring to discuss my assignment, so I found it very useful. It is hard as an external student to know sometimes if you are on the right track, so having the opportunity to discuss things was great."

External students who did not participate in Elluminate *Live* reported they were limited by technology issues including no microphone/camera access at home; and the times of scheduled sessions were not convenient due to prior work or family commitments.

Discussion

The trial of the digital learning technologies in EIHP 100 resulted in some positive feedback from the perspective of the students. Most notable was the provision of the large projection screens around the learning space that provided students with easy visual access to important information being discussed in class. The shift to larger class size (up to 100 students) in the interactive seminar-style EIHP 100 classes required refurbishment of the classroom environment. To fully engage students in such a large room, the traditional concept of teaching from the 'front of the class' was abandoned, and the tutors facilitated the class activities from the centre of the room. This ensured that even students in the outermost groups of desks in the room were only two or three desks away from at least one of the three tutors; and therefore, were able to see and hear what was being said. Despite this, there was overwhelming consensus in the student feedback for EIHP 100 on the university's eVALUate system that students did not like the very large class size, and would prefer to be in an interactive learning environment with no more than 50 students per class.

Almost 90 per cent of respondents to our survey agreed the downloadable lecture content provided them the opportunity to access the necessary information at a time that was convenient to them. This supports the findings from the report by Krause and colleagues (2005) that identified Australian tertiary education students commonly work while studying, in addition to other family commitments. Removing the requirement to attend a face-to-face lecture at a time determined by the university timetabling system, allows students the flexibility to access the learning materials at a time and location convenient to them. While this doesn't guarantee students will access the online materials in a timely manner to prepare for each week's in-class seminar or self-directed online learning activities, it does give students the option to be able to access the material at another time. More than three-quarters of respondents agreed the downloadable lectures also enhanced their learning by allowing them to review the lecture material as many times as needed. This was especially important in EIHP 100 given the large number of international students from non-English speaking backgrounds that were enrolled in the unit.

The use of audience response devices in large size classes is commonly reported in literature (Kay & LeSage, 2009) and generally speaking students enjoy using this technology (Kenwright, 2009). The audience response devices were used during in-class learning activities in EIHP 100, but not for formative assessment. The key themes from the students' qualitative feedback was that the audience response devices (clickers) were effective in capturing students' attention in class; engaging them in the learning activities; and the anonymous nature of the responses increased students' confidence to answer questions in a large class setting. These identified benefits are consistent with the findings of prior studies among students in a large class environment (Bergtrom, 2006; Patterson, Kilpatrick, & Woebkenberg, 2010). Others have identified that the response devices can provide immediate feedback to students and academic staff about how well the whole

class understands the learning concepts being covered, and certain aspects that required further explanation or discussion could be addressed immediately (Kay & LeSage, 2009). However, the application of this technology beyond their use as a MCQ tool should be explored to exploit collaborative and problem-based learning, and development of critical thinking skills (Bergtrom, 2006). Our study did not aim to determine if the response devices improved student learning outcomes, and prior studies are inconclusive about the effect on academic performance when response devices were used; no significant improvement was found by some researchers (Duggan, Palmer, & Devitt, 2007; Stein, Challman, & Brueckner, 2006), while others reported significant improvements in students' test scores when response devices were used in class compared to previous test scores (Hall, Collier, Thomas, & Hilgers, 2005). The impact of this digital technology on achievement of learning outcomes requires further investigation.

Furthermore, the ability of academic staff to successfully use these technologies will impact on how well they are integrated into the in-class activities. Duggan et al. (2007) compared the academic performance and opinions of students, and the opinions of lecturers in two classes where response devices were used, with the academic performance and opinions of students and opinions of lecturers in two traditional classes. Lecturers who valued the use of the response devices tended to be more confident with digital technologies, than those who preferred the traditional format. This highlights the importance of providing adequate professional development, training and mentorship to academic staff that may be unfamiliar with the use and application of digital learning technologies. More training and peer support with the use of the audience response devices will be provided to academic staff in EIHP 100 to further enhance the teaching and learning experiences of both the staff and the students.

The provision of laptop computers for in-class group activities was not successful in EIHP 100 as a result of insufficient wireless capability to support a large number of simultaneous users. Although the teaching space provided wireless capability for up to 70 wireless devices, students' own mobile technologies including smart phones, laptop computers and other personal digital assistants (PDAs) that were brought into the classroom competed for the wireless signal. This resulted in many students being delayed or unable to log onto the university provided laptops in order to complete various team-based learning activities that required students to find relevant information via the Internet. Consequently, the laptop computers were more a source of frustration than support among students and staff. In response to these technical difficulties, the teaching space has now been hard-wired for Internet access. This infrastructure upgrade will remove the delays experienced by students using the laptop computers (iTALC.), and will also allow for other teaching and learning technologies that provide opportunity for collaboration and sharing among and between students in the large size class environment to be trialled, such as the free Intelligent Teaching and Learning with Computers (iTALC.) software.

Only about one-third of respondents found that the student-authored wiki summary of each week's in class learning activity enhanced their learning in this unit. It was hoped that this team task would provide students with an opportunity for just-in-time learning and interactivity through collaborative reflection of the concepts they had learned, and also provide them with feedback about their learning from their peers. However, only very few students provided comments on their peers' wiki entries, despite the fact that some of the team summaries were exemplary. There are possible explanations for why students did not find this activity helpful to their learning in this unit. The first is that while there was an expectation that this team task would be completed by each team of students at least once in the 12-week semester and that other students would review the wiki summary each week to support their learning, neither the writing of the summary nor the comments posted by other students were formally assessed, and so if students did not complete either the wiki summary or review and post comments on others' summaries, there was no penalty to their grade for the unit. Students who are externally motivated to learn rely on rewards and desirable outcomes (e.g. academic grades) compared to intrinsically motivated students who engage in learning activities through curiosity, a desire to be challenged and social bonds formed through learning activities (Williams & Williams, 2011) are less likely to engage in non-compulsory or graded learning tasks that they do not see as valuable. This is related to the second explanation for students' disagreement with the learning value of the wiki summaries; there was no final examination for EIHP 100. The summaries of the weekly learning concepts written by the teams provided a comprehensive overview of the unit content written from the students' perspectives and in language that was accessible to other students. However, without the requirement to study for a final examination addressing this content, students may have perceived there to be no value in reading the weekly summary. Given that EIHP 100 is worth half the credit points of the other compulsory core units in the common first year, and students seem not to value the opportunity for teamwork and collaborative learning provided by this wiki task, the burden of this team activity appears to outweigh potential benefits.

A major limitation of this study was the very low response rate by the total number of students enrolled in the unit who were invited to participate in the study. One reason for the low response rate by students may have been because the same cohort of students were also being surveyed about their learning experiences with the common first year curriculum, especially with regard to IPE, possibly leading to respondent burden. As a result the feedback provided cannot be considered representative of the students enrolled in EIHP 100; however, has provided the unit coordinators with ideas for improvement in the use of the learning technologies for the following academic year.

Conclusion

A range of digital learning technologies were trialled in a compulsory unit in the common first year of all health sciences degrees at Curtin University in 2011. Students who participated in the survey reported access to downloadable lecture material allowed them to view lecture material at a time convenient to them, and allowed them to view the material as many times as needed to gain understanding of the content. Students also had positive attitudes toward the use of audience response devices during in-class activities as a way to provide anonymous formative feedback about their understanding of learning concepts, as well as an avenue for expressing their opinion on a topic without being identified individually. This was most helpful for students who felt shy about speaking in front of a large group.

Challenges to the successful implementation and uptake of these technologies included limitations to wireless capabilities, variability in the skills and confidence of academic staff to use the technologies in the classroom, and students' perceptions that student-authored review activities were time consuming and of little additional benefit to their learning. Further evaluation of the effect of these learning technologies on students' engagement and learning outcomes is planned in future years.

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[eScholar 2011 – Marina Ciccarelli – Case Study Video](http://youtu.be/33ncOZI5tvA)

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The impact of eLearning tools on the interprofessional learning experience in a first year foundations health unit

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KEYWORDS

Interprofessional education, health sciences, elearning tools, student engagement

Abstract Foundations for Professional Health Practice 100 is a first year first semester unit that was developed for the Faculty of Health Sciences' interprofessional common first year. To investigate the effectiveness of eLearning tools to assist the students in meeting two of the unit learning outcomes a cross sectional survey was undertaken. Results of the survey demonstrated that most eLearning tools (eg. Blackboard quizzes, wiki, Elluminate *Live!*, iPortfolio, Turnitin, and vodcasts) were effective in enabling students to achieve one or more of the course learning outcomes. These results show the value of using eLearning tools in first year tertiary courses to enhance student engagement and academic progress.

Introduction

Student engagement and the development of lifelong learning skills at the tertiary level commence with the first year experience. Kift (2009) identified that first year curricula should support students as they make the transition to tertiary education and take into consideration the diverse skills and backgrounds of students as they enter university study. In addition, curriculum should be designed to engage students through active and collaborative learning and promote learning communities through active and interactive learning opportunities, peer to peer collaboration and student – teacher interaction (Kift, 2009). In 2011, these principles along with the introduction of interprofessional education were key drivers for the introduction of a common first year in the Faculty of Health Sciences at Curtin University.

Interprofessional education (IPE) enables students to learn with, from and about each other so that as future health professionals they can work together, safely and effectively to meet the needs of future clients in a variety of health care settings (Curtin University, 2011). The Faculty of Health Sciences Interprofessional Capability Framework (Curtin University, 2011) identified five capabilities (communication, team function, role clarification, conflict resolution, reflection) that, if achieved, would enable graduates to

provide safe, high quality care utilising collaborative practice, fundamental to achieving client centred service in health care. These capabilities were crucial in the development of the curriculum and learning environment for Foundations for Professional Health Practice 100 (FPHP 100), a large core unit introduced within the common first year of all undergraduate degrees offered in the Faculty of Health Sciences.

As advanced technologies are increasingly integrated into health care practices, it is vital that students experience technology integrated learning (Carbonaro, et al., 2008). eLearning technologies are becoming more affordable and more widespread in their use in tertiary study (Hosie, Schibeci & Backhaus, 2005) and can be successfully used to promote and support IPE (Luke et al., 2009; Solomon et al., 2010). In keeping with Kift's (2009) principles, eLearning tools employed in FPHP 100 were aimed at enhancing accessibility to diverse student groups and modes of study, promoting active learning and peer to peer interaction. The purpose of this eScholar grant was to incorporate and evaluate different eLearning tools to assist students to work in an interprofessional team, understand the meaning of interprofessional education and develop academic writing and presentation skills.

Background

The FPHP 100 unit was designed and developed during 2010 by an interprofessional team from across the Faculty of Health Sciences and first taught in 2011 to 2300 students (1850 in semester 1 and 450 in semester 2) with more than 30 teaching staff (including sessional) involved. The unit was delivered internally and externally at two regional campuses (Albany and Geraldton). The unit coordination team included a unit coordinator, deputy unit coordinator and a teaching support officer who provided administrative support to all staff and students in the unit. Students were taught in weekly three hour blended learning workshops of 50 students (from varied disciplines) with two interprofessional tutors per class.

The first semester cohort included students from biomedical science, nursing and midwifery, occupational therapy, pharmacy, physiotherapy, psychology, public health, social work and speech therapy, whereas students in the second semester were predominantly from the areas of nursing, midwifery and public health with smaller numbers of students from all other disciplines, maintaining the interprofessional educational context.

In recognition that professional skills development starts from year 1, FPHP 100 focused on the skills needed to work as a health professional in an interprofessional environment including the academic skills needed whilst a student, as illustrated in the following unit learning objectives. This eLearning project specifically addresses how students perceived the effectiveness of eLearning tools in achieving the unit learning objectives 1 and 2.

1. **Demonstrate academic integrity, effective information search strategies and referencing skills required for tertiary study.**
2. **Apply professional oral, written and interpersonal communication skills within an interprofessional learning environment.**
3. Compare and contrast Australian and international health systems.
4. Describe the key elements of ethical and professional standards and behaviours in health which impact on the safety and quality of client centred service / care.

Classrooms were arranged for students to work in learning groups of 4-6 students, with each learning group having access to laptops and iPads provided by the university, although students were encouraged to bring and use their own devices if available. Learning groups were established in week 1 of semester and included students from a range of different courses to facilitate and encourage interprofessional learning. These groups stayed together for the duration of the semester and worked as a team in both classroom and assessment activities. In view of the difficulties often experienced by external students attempting to work in interprofessional groups Elluminate *Live!* (as described below) was used to overcome the barriers of physical distance and multiple time zones.

During the workshops students worked individually and in their learning groups on activities designed to engage and support them to achieve the above mentioned learning objectives 1 and 2. Several eLearning tools (Blackboard, vodcasts, WIKI, Stilwell (online virtual community), Turnitin, iPortfolio and Elluminate *Live!*) were used to promote active and collaborative learning including assessment and feedback.

A Learning Management system, as highlighted by Ellaway and Masters (2008, p. 459) provides an integrated 'suite of tools and services' to staff and students in a unit.

Blackboard, the Learning Management System used at the university was deployed in a number of ways. Prior to each week's workshops all materials, including vodcasts and worksheets were available for staff and students to view and download. Under the 'Resources' tab profession specific pages were incorporated among the workshop materials to provide students with an orientation to their own and other's professions; these materials were written by various faculty staff and included links to professional websites and information about registration and roles in the health care team. Resources pertaining to assessments were made available to staff and students; these included instructions, sample assessments and feedback guides. Assessment and tutor feedback was undertaken with the use of the 'Grade Centre'. 'Discussion' boards, one for each class as well as a separate one for staff were utilised for peer to peer as well as peer to teacher communication and 'Announcements' were used for weekly updates and other communication from the Coordination team to all students.

One of the challenges of a large unit that does not have formal lectures is how to present material from experts in the field in a time efficient way that engages students in a

blended classroom environment. To meet this challenge, short (10-30 minute) vodcasts (short videoed lectures) were recorded and shown to students in class interspersed with activities that demonstrated or highlighted the practical application of what had been presented. External students were able to view the vodcasts on Blackboard. This proved to be an efficient means to achieve consistency across the internal and external groups and overcame the burden of a lecturer having to repeat a live presentation to 35 tutorial groups in a week.

A **WIKI** as described by Ellaway and Masters (2008) was created to assist students with the development of their academic writing as a 'Guide to Assignment Presentation'. A hard copy version of this resource (Portsmouth, Bathgate & Gazey, 2010) had been previously used in a core unit in the Faculty of Health Sciences to provide students with detailed instructions and examples of assignment formatting, language, structure, citing and referencing. This printed resource had the problems of being expensive and time consuming to annually update, produce and make available for all students. The printed book was also not editable between versions so correction of errors or updates could only be made annually. For these reasons an online version as a WIKI was created to allow for easy and instant editing and updating by teaching staff and to be accessible for all students regardless of location or study mode and at no cost to students. Students were unable to edit the WIKI as it was an academic reference.

Stilwell, a virtual community developed by the University of Cumbria in the UK, was available as a Blackboard site. This innovative, interactive online community featured health care critical incident videos, medical records and social histories of residents of the fictional town of Stilwell as well as a local newspaper and maps. Stilwell was used in both class activities and assessments to provide 'real life' case studies for research and discussion. Each learning group in the class was assigned one case study (e.g. heart attack) at the beginning of the semester which they worked on in class and as the basis for the major assessments. Students researched both the condition and the physical, social and emotional needs of the patient and the community, with a particular focus on the importance of interprofessional care for sustainable and successful client centred outcomes.

Turnitin was used as a teaching and learning tool to support students in developing their academic writing and referencing skills. Students were taught in class how to interpret the features of Turnitin reports and best use the feedback to build on their academic research, writing and referencing skills. Students were encouraged to submit up to two drafts of their written assignment and make changes based on feedback received prior to submitting their final copy for assessment.

An ePortfolio is an individual online repository of events, reflections and assessment (Ellaway & Masters, 2008) and Curtin University's **iPortfolio** was utilised as a tool for evaluating student development of key professional skills and as a means of giving and

receiving feedback by tutors and interprofessional peer learning groups. This tool provided an online space for students and staff to create, share and publish evidence of their learning achievements and professional development. It provided social networking features that encouraged students to seek feedback from peers on their work and achievement of learning objectives.

Illuminate *Live!*, an online virtual classroom, provided a forum where external students met weekly to engage with each other and the subject content, which included interprofessional collaborations and clarification of assessment requirements. *Illuminate Live!* provided the flexibility that permitted students from multiple locations and different time zones to join in these sessions run by the external tutor at least twice a week. The sessions were recorded enabling those who did not attend the live forums to listen / view the recordings at a time convenient to them.

Purpose, aims and objectives of the research project

Given the specific context in which FPHP 100 was (and continues to be) taught (i.e. large class, dispersed cohort, interprofessional learning), the project team sought to explore interesting ways in which the integration of multiple learning technologies could be used to leverage student learning, whilst simultaneously articulating the priorities for first year curricula. The overall aim of this research project was therefore to evaluate the impact of interprofessional education (IPE) eLearning tools on first year student experiences in a large health science unit.

Specifically, the research aimed to answer the following questions:

1. What are first year health science students' general computer skill levels before and after completion of FPHP 100?
2. Do specific eLearning tools impact on students' development of academic writing and presentation skills?
3. Do specific eLearning tools impact on students' understanding of the definition of IPE as "Occurrences when two or more professions learn with, from and about each other to improve collaboration and the quality of care" (CAIPE (2002), as cited in Curtin University, 2011, p.3).
4. Do specific eLearning tools impact on the student experience of working in an IPE student team?

Methods

Study design

The study design involved a cross-sectional survey of first year health science students enrolled in the Faculty of Health Sciences for the year 2011. As the main aim of the study was to evaluate students' experiences with using a range of eLearning tools to meet the specific FPHP 100 learning outcomes, an online survey was conducted.

Online survey tools, rather than other data collection methods, were used within this study to allow for a large sample of data to be collected, and to accommodate both internal and external students. Data was collected at the end of each semester (i. e., June and October 2011), and access to the online surveys was gained from a link posted on the FPHP unit in Blackboard. Both internal and external students had full access to the FPHP 100 Blackboard site and survey links.

Sample

Students (n=384) from 19 schools/discipline areas throughout the Faculty of Health Sciences participated in the study.

Current enrolment in the FPHP 100 unit was the only inclusion criteria for participation in the study. As participants accessed the surveys via the FPHP 100 Blackboard site this ensured that access was limited to current and enrolled students. No students were excluded from participating in the study.

Participation in the study was voluntary and anonymous. Students were requested to participate in the study via 'in-class' announcements made by tutors, and via a general email sent to FPHP 100 students by the unit coordinator. Information given to students included where to access the surveys and survey access (open/closing) dates. Survey completion occurred outside of class time, at a time convenient to students.

Student enrolment (both internal and external) in the unit numbered 1850 students in semester 1 and 450 students in semester 2. The overall participation rate for the study was low (19.5%). It is likely that conducting the study at the end of semester when students were preoccupied with exam preparation and likely to have encountered other requests for participating in surveys (e.g. general first year experience survey and eVALUate) contributed to the low response rate.

Survey procedures

The surveys were developed and piloted with a small group of students (n=5) prior to the survey link being posted on the FPHP 100 Blackboard site. Tutors were instructed to demonstrate to students in class the location of the survey link and how to access the survey via Blackboard. For external students the tutor demonstrated access and procedures via Elluminate *Live!* and email.

There were two surveys used in the study. The main survey was completed by all participants. As only external students in semester 2, 2011 (n=28) used the eLearning tool, Elluminate *Live!*, these students were asked to complete an additional separate survey following semester 2. The surveys were available for a two week period to allow for as many students as possible to complete it. Timing of the survey completion indicated that most students would be able to complete the surveys within a 20 minute time period. Students were able to complete the surveys from any place they could access

their Curtin OASIS account and the unit's learning management system. Information regarding the surveys and instructions for the completion of the surveys were written at the commencement of each online survey. This information allowed for informed consent.

Survey tool

The survey tools used within this study were developed using Survey Monkey. The online surveys were structured into three sections.

Section 1: Demographics

Section 2: Computer use / experience

Section 3: Students rating of eLearning tools to meet the course outcomes.

Section 1 contained four questions pertaining to age, gender, school enrolled in and mode of study.

In Section 2, computer skills and experience were measured using confidence scales based on an analogue scale of 1 – 10, with 1 indicating 'not confident', 5/6 – 'reasonably confident' and 10 – 'totally confident.' This section contained 10 questions to assess computer skills / experience both prior to commencing and on completion of participating in the FPHP 100 unit. Questions included computer skills / experience using computers for the following types of programs; Word, PowerPoint, searching library sources, email, internet, Blackboard, and WIKIs.

In Section 3, the extent to which particular eLearning tools facilitated achievement of specific learning outcomes and or the study aims was investigated. The measurement scale comprised of categorical agreement ratings, namely 'strongly agree', 'agree', 'neither agree/disagree', 'disagree', 'strongly disagree' and 'not applicable.'

Data analysis

Descriptive statistics (%) were used to describe the sample and to examine the relationships between variables. Chi squared (χ^2) analyses were also used to examine the relationships.

All results are reported using up to three decimal places depending on the statistical methods used, with alpha probabilities also reported to three decimal places. A criterion alpha of .05 was used throughout the results.

Ethical considerations

This study was approved by the Curtin University of Technology Human Research Ethics committee.

The online survey contained an introduction section explaining the aims of the study and that participation was voluntary and information collected would remain confidential.

There was no identifying information collected. Those not wishing to continue with the survey could exit the survey at any time. Completion and submission of the online survey by the students was taken as consent to participate.

Data storage

Survey results are stored in a secure location at Curtin University. All data collected for this study are the property of Curtin University and will be stored in a confidential and secure location for a minimum five years as specified by the National Health and Medical Research Centre (NH&MRC) guidelines. Stored data will only be accessible to the researchers.

Findings

The results of this study are presented below under the headings of Demographics, Computer Skills and eLearning tools.

Demographics

A total of 384 students participated in the main survey, 342 in Semester 1 (or 18.5% of semester 1 internal enrolments) and 42 (or 9.3% of semester 2 internal enrolments) in Semester 2. An additional 28 (or 24% of semester 2 external enrolments) external students completed the separate survey on the use of Elluminate *Live!* in Semester 2. Results from this Elluminate *Live!* survey are documented under Elluminate *Live!* below in Table 3 and indicated by **.

Age:

The majority of participants were aged < 20 years. Table 1 shows the main survey participants' age by category.

Table 1: Demographics of students by age

Age category	% of participants
Under 20 years	64.5
20-25 years	16.4
26-35 years	10.7
Over 35 years	8.4

Gender:

83% of participants were female, and 17% male.

Schools:

Participants were from a range of schools within the Faculty of Health Sciences as shown in Table 2.

Table 2: Enrolment of FPHP 100 students by school

Faculty of Health Science Schools	% of participants
Biomedical Science	7.9
Nursing / Midwifery	19.3
Occupational therapy / Social work	16.8
Pharmacy	10.9
Psychology / Speech therapy	15.3
Public Health	20.2
Physiotherapy	9.4

Computer skills

Nearly all participants (99.1%) reported the ability to use computers for generic tasks such as using Microsoft Word and email prior to their commencement of FPHP 100. Participants were however, less likely to have technical skills in using the specific learning technologies integrated in FPHP 100, namely Elluminate *Live!*, Blackboard, iPortfolio and WIKIs. Table 3 presents the reported before and after computer skills of FPHP 100 students.

Table 3: eLearning tools before and after participation in FPHP 100

eLearning tools	Participants' self-assessment of their computer skills before commencing FPHP 100 (%)	Participants' self-assessment of their computer skills following completion of FPHP 100 (%)
Blackboard	82.6	99.1
iPortfolio	38.8	98.3
WIKI	46.4	87.8
**Elluminate <i>Live!</i>	17.4	70

eLearning tools

Participants reported the usefulness of the range of eLearning tools in meeting the FPHP 100 Unit learning outcomes. The results demonstrate that different eLearning tools were reported to be useful in achieving different learning outcomes. This supports the use of a range of eLearning tools in a large unit with multiple learning outcomes. Table 4 demonstrates that the use of the WIKI and Turnitin had the most impact on meeting the learning outcome of developing academic writing skills.

In developing skills to meet course requirements of developing an understanding, and experiencing IPE, the eLearning tools reported to have the most impact included the use of the online community **Stillwell** and the **iPortfolio** task of working online within a collaborative network.

Table 4: Percentage agreement on eLearning tools that facilitated achievement of FPHP 100 unit learning outcomes

N = 384	% of respondents		
FPHP 100 learning outcomes	Agree	Neither agree / disagree	Disagree
Developing academic writing and presentation skills			
Using Blackboard for a referencing quiz	62.9	22.0	15.1
Viewing vodcasts	36.9	33.1	29.9
Using a WIKI for assignment presentation guidelines	70.3	18.2	11.5
Viewing Stilwell case studies and use in assessments	47.8	26.7	25.5
Using Turnitin (to build effective research writing, citation and referencing skills??) for assignment writing	80.5	12.2	8.4
Completing the iPortfolio "About Me page" – link to study aims not clear??	57.1	22.9	20.1
Inviting an iPortfolio collaborative network – as above	47.6	22.2	27.9
To understand the meaning of interprofessional education, as defined by CAIPE (2011)			
Using Blackboard for a referencing quiz	40.2	30.4	29.7
Viewing vodcasts	43.9	31.6	24.5
Using a WIKI for assignment presentation guidelines	43.5	30.4	26.1
Viewing Stilwell case studies	65.7	21.4	12.9
Using Turnitin for assignment writing	48.7	27.7	23.6
Completing the iPortfolio "About Me page"	52.2	26.1	21.7
Inviting an iPortfolio collaborative network	60.3	22.4	17.4
Working within a student interprofessional team			
Using Blackboard for a referencing quiz	46.8	26.7	26.4
Viewing vodcasts	42.7	30.7	28.8
Using a WIKI for assignment presentation guidelines	50.2	25.1	24.7
Viewing Stilwell case studies	69.0	19.4	11.7
Using Turnitin for assignment writing	55.6	22.1	22.3
Completing the iPortfolio "About Me page"	53.6	23.7	22.5
Inviting an iPortfolio collaborative network	58.3	21.1	20.5

Illuminate Live!

Of those external students in semester 2 (n=28) reporting use of this eLearning tool 82% were female and 18% male. 21% of these students attended > than 5 sessions (out of 9) throughout the semester and 74% more greater than 3 sessions. 87% of students reported that attendance at *Illuminate Live!* sessions was helpful to understand the unit's assessment requirements, and 82% reported that the sessions were helpful to understand

the course materials. Anecdotal feedback via Curtin University's eVALUate survey conducted at the end of Semester 2, 2011, included comments such as:

'As an external students Elluminate Live! was extremely helpful';

'A great tool to give access to a tutor';

'I was unable to attend the Elluminate Live! sessions, however listened to the recordings which was very helpful'; and

'A great way to hear how other students are getting on with their work'.

Discussion

The majority of students who completed the survey were female, with almost two thirds being recent school leavers, aged less than 20 years. Most students were enrolled in the Schools of Public Health and Nursing and Midwifery. These schools have large first semester intakes and a significant second semester intake, which likely contributed to the large enrolment into FPHP 100 in semester 1, 2011.

Development of eLearning computer skills

Upon entry into FPHP 100, the study participants' self-assessment of their computer skills varied considerably for the four tools used, with Blackboard identified most favourably followed by WIKI, iPortfolio and Elluminate *Live!*. It can be expected that commencing students' skills in using the latter two of the eLearning tools might be limited due to not having used them previously. However, on completion of the FPHP 100 semester, students indicated significant improvement in their capabilities to use these tools. As these computer skills will be applied in progressive units, the development of these skills within the course is imperative for future academic success.

Developing academic writing and presentation skills

The use of **Blackboard** for activities such as electronic quizzes, viewing resources such as discipline specific sites, accessing library information and the online STILWELL community, impacted on students' ability to meet the unit's learning outcomes pertinent to the development of academic skills. Additionally, there were significant associations between participant's age and use of Blackboard for these activities. For example, older students were more likely to report that Blackboard activities (Stilwell ($\chi^2(2)=6.29$, $p=.043$) and discipline specific pages ($\chi^2(2)=9.85$, $p=.007$) were effective in developing academic integrity skills and an understanding of IPE.

The use of a **WIKI** for assignment presentation guidelines and **Turnitin** were reported to have the highest impact on meeting academic skills learning outcomes in FPHP 100. Of those who responded, 70.3% agreed that the use of a WIKI and 80.5% agreed that Turnitin positively impacted on their ability to meet academic skills learning outcomes.

These two eLearning tools were used to teach the academic skills of paraphrasing, citation and referencing; vital for academic success at the tertiary level by providing reference material (WIKI) and providing feedback on earlier drafts (Turnitin).

Understanding the meaning of interprofessional education and working in an interprofessional team

Interprofessional education and practice were new concepts to students entering this unit however from week one the relevance of interprofessional education as defined by CAIPE, and cited by Curtin University (2011) for the provision of safe and high quality client centred care was demonstrated through the interprofessional composition of the class, the teaching staff and learning activities using specific eLearning tools.

The use of the **iPortfolio** for formative assessment in the form of self, peer and tutor feedback throughout the unit provided opportunities for students to engage by receiving and providing feedback. This also assisted in providing critical feedback for first year students' learning experience (Kift, 2009). Unit requirements of self reflective practice to meet the iPortfolio assessment requirements again demonstrated students' ability to engage with the curriculum. Additionally, inviting the collaborative iPortfolio network enhanced the student's learning community, with students reporting that iPortfolio assisted in developing the required graduate attributes and experience of working within an interprofessional team. The opportunities demonstrated in this case study supported the continued use of iPortfolios in FPHP 100 into Semester 2, 2011, although some modifications were made to the frequency of use and number of assessments uploaded to the iPortfolio due to technical difficulties experienced with the technology in semester 1.

The **STILWELL** case studies were effective in showcasing how different health professionals work together to benefit patients/clients using a range of common 'real-life' scenarios. A number of perspectives were presented both from the health professionals, the patients and the community which demonstrated the complexity of health care and helped students to define their as well as others' roles in the health care team. This multimedia approach engaged students with over two thirds of respondents confirming it helped their understanding of interprofessional education and working in an interprofessional team.

Students felt the use of **vodcasts** either in class or online though Blackboard did not help to develop their academic skills or their understanding of interprofessional education or working in an interprofessional team. As the vodcasts were primarily information giving they did not support active and interactive learning opportunities or peer to peer /teacher interaction (Kift, 2009), which is vital for student engagement.

Conclusion

Technology is an increasing tool in everyday life, with eLearning technologies now being an integral part of tertiary studies. Furthermore, with universities developing large common first year programs with student enrolments >1800 students per semester; the use of technology and eLearning strategies are important to assist in managing the quality of these programs. As recent literature emphasizes the importance of engaging students in their first year to assist with future academic success, it is therefore critical that these large first year units utilise effective eLearning strategies for student engagement and hence, their academic progression.

The aim of this study was therefore to firstly investigate student's eLearning skills, and secondly, the effectiveness of a range of eLearning tools in assisting students to meet course specific learning outcomes. Results from surveying the students demonstrated that on completion of the FPHP 100 course, students rated themselves with having enhanced computing / eLearning skills. Additionally, the use of a range of eLearning tools within the context of this large first year unit, was reported to be effective in assisting students to meet the learning outcomes of the unit, thus academically progressing students through their course.

Results from the study also highlighted the importance of using a range of eLearning tools as students reported the usefulness of different eLearning tools to meet different learning outcomes. For example, understanding the meaning of interprofessional education, and working within an interprofessional student team, was achieved by utilising innovative eLearning strategies such as iPortfolio.

In light of these results, strengthening the use of these eLearning tools within the FPHP 100 unit is recommended, for example for development of the use of tools such as Turnitin and the WIKI to further enhance academic integrity skill attainment.

In addition to the strengthening of the use of these eLearning tools, with future development of the FPHP 100 unit, embracing new eLearning technologies (such as the use of iPads) to further support the unit's teaching and learning strategies would be encouraged.

Postscript

Results from this study were presented by the authors at the 3rd Biennial Interprofessional Education Conference 'Collaboration Across Borders' (CAB III) in Tucson, Arizona in November 2011.

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